

Ballantine



**MODEL
3036 SERIES
DIGITAL
MULTIMETER**



INSTRUCTION MANUAL

MODEL 3036 SERIES DIGITAL MULTIMETER

Serial Prefix No. 020- & 021-

INCLUDES:

Model 3036A Digital Multimeter
Model 3036B Digital Multimeter
Model 3036B-968 Environmentalized Digital Multimeter

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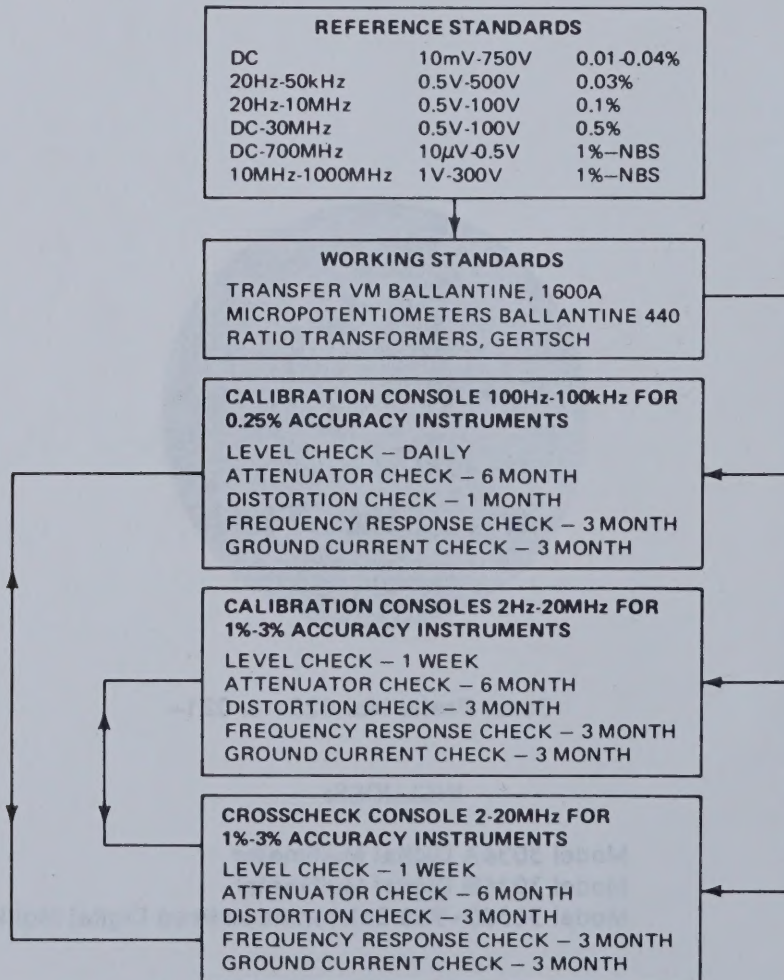


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Figure 1-1. Model 3036A/B Digital Multimeter

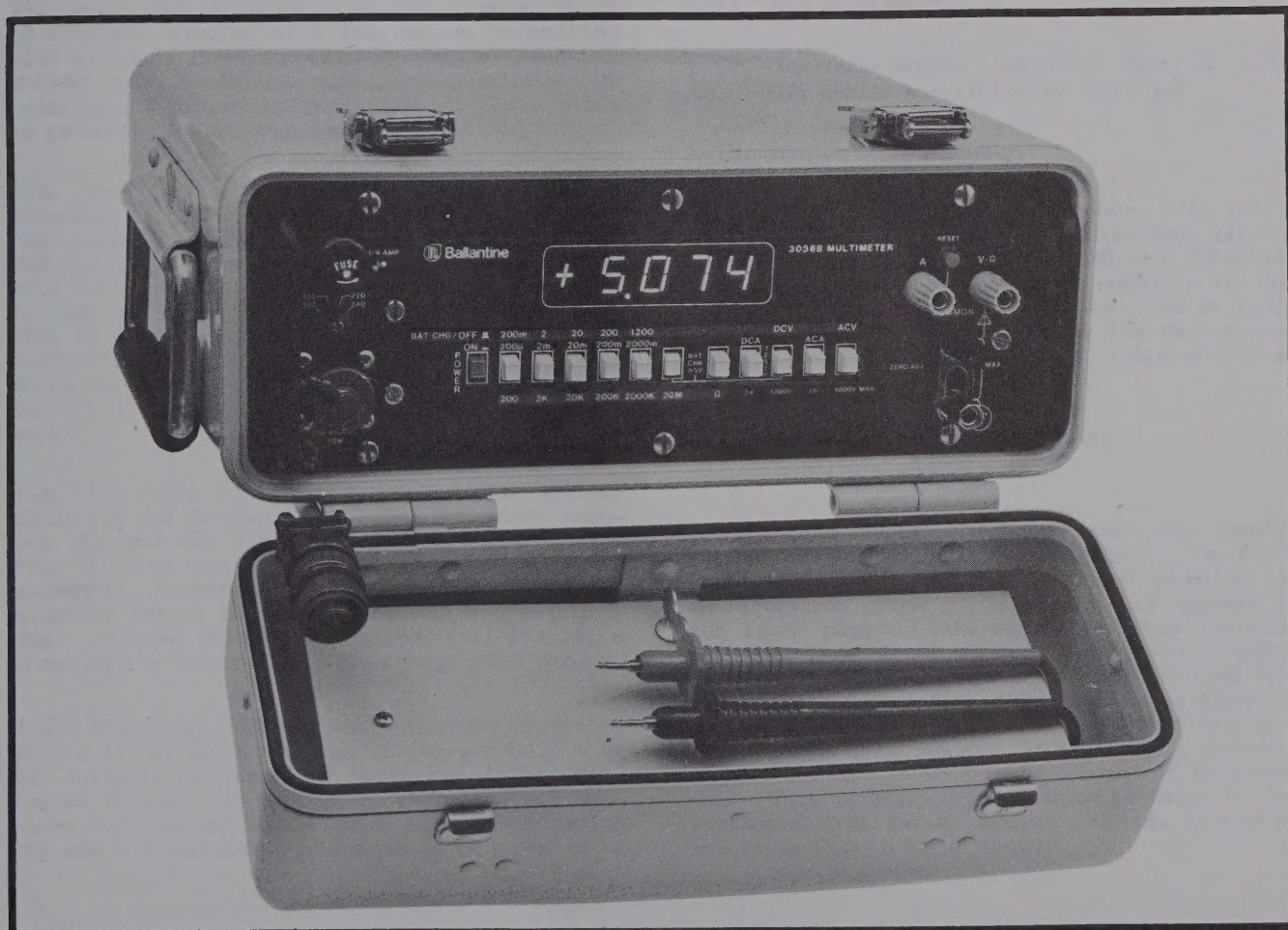


Figure 1-2. Model 3036B-968 Environmentalized Digital Multimeter

SECTION 1

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual provides operation and maintenance information for the Ballantine Model 3036A/B Digital Multimeter. Section 1 is a general description of Model 3036A/B. Sections 2 and 3 contain installation and operating instructions. The theory of operation is described in Section 4. Section 5 outlines maintenance and troubleshooting procedures. Section 6 has tables of replaceable parts and recommended spare parts. Section 7 describes accessories. Section 8 details modifications and options.

1-3. DESCRIPTION

1-4. The Ballantine Model 3036A Multimeter is a 4-1/2 digit, five function instrument which measures ac and dc voltages, ac and dc currents, and ohms. The Model 3036B is similar to the 3036A but features tighter accuracy specifications. The 3036B-968 is ruggedized and environmentalized.

The instrument features a bright orange 11 mm (0.43") LED display of 4 1/2 digits, permitting plus or minus 19999 counts. The decimal point is automatically positioned with range selection. DC polarity is automatically indicated. Zero drift is prevented by an autozeroing circuit.

1-5. The Model 3036A/B is well protected against overloads. 1200 V on any DC voltage range, 750 V rms (1000 V on 3036B-968) on any ac voltage range and 285 V power mains voltage on any ohms ranges will not damage the instrument. Overload recovery is fast, enabling measurements to continue with no loss of time. Protection is provided by means of electronic limiters except for the current range where the input is circuit breaker protected. The circuit breaker RESET is accessible on the front panel.

1-6. The Model 3036A/B features built-in battery condition and display tests. Simultaneously pushing DCV and DCA will light all segments on the four LED displays for a quick check of all seven segments. Rechargeable battery operation is provided by Option 05 and is standard on the 3036B-968. Pushing DCV and 20 Megohms will provide a check of the internal battery charge condition.

1-7. The Model 3036A/B may be operated either from a 115 or 230 V ac power adapter, 9 to 14 V dc or internal rechargeable batteries (NiCad batteries Option - 05). The built-in charger provides full charge in 14 hours with POWER switch OFF and the instrument connected to dc power or ac

power adapter. The batteries will be trickle charged with the POWER switch ON. The unit may be operated from dc or ac power adapters with or without batteries installed. The 3036B-968 does not require an AC Power Adapter and operates directly from AC mains and internal batteries.

1-8. The instrument is housed in a rugged and attractive shielded plastic case. It is small and light enough to be easily carried. The 3036B-968 is housed in a sealed aluminum combination case which includes a protective cover. Quality components and reliable design techniques are used throughout to assure high reliability and low power consumption. A single circuit board is used for reliability and rapid maintenance.

1-9. SPECIFICATIONS

1-10. Specifications for the 3036A are listed in Table 1-1, in Table 1-2 for the 3036B and in Table 1-3 for the 3036B-968.

1-11. ACCESSORIES

1-12. The accessories available for use with Model 3036 Series are listed in Table 1-4.

1-13. Manual Applicability.

1-14. All references in this manual will be to the 3036A Digital Multimeter. All options will be detailed in Section 8. The 3036B and 3036B-968 are similar in all functional respects to the 3036A and their accuracies are detailed in Table 1-2 and in Table 1-3 as well as the Maintenance Procedures of Section 5 and parts lists and schematics of Section 6.

1-15. INSTRUMENT AND MANUAL IDENTIFICATION

1-16. These Ballantine instruments are identified by a two section serial number. The first three digits section of this number identify the configuration code. This code number appears on the front page of this manual and must coincide with the first three digits of the serial number of your instrument. Addendum sheets supplied with the manual will define technical corrections or differences between your instrument and the unit described in this manual. If applicable, backdating information is located at the end of this manual. This backdating information pertains to instruments with serial number prefixes listed on the title page of this manual.

TABLE 1-1. 3036A SPECIFICATIONS

DC VOLTAGERANGES: ± 200 mV, ± 2 V, ± 20 V, ± 200 V, ± 1200 VRESOLUTION: ± 10 μ V on 200 mV range

ACCURACY:

1 year, 20°C to 30°C

All ranges: $\pm(0.05\%$ of reading +1 LSD)INPUT IMPEDANCE: 10 M Ω all ranges

NORMAL MODE REJECTION:

>60 dB at DC, 50 Hz and 60 Hz

COMMON MODE REJECTION:

>120 dB at DC, 50 Hz and 60 Hz

(with 1 k Ω unbalance, common driven)

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.005\%$ of reading)/°C

ZERO STABILITY: Auto zeroed on all ranges

POLARITY: Automatic bipolar + or - display

OVERLOAD: ± 1200 V dc or 1200 V peak ac continuous

RESPONSE TIME: 1 second max. to rated accuracy

ACCURACY:

1 year, 20°C to 30°C

10% of full scale to full scale

30 Hz to 45 Hz $\pm(1\%$ of reading +5 LSD)45 Hz to 20 kHz $\pm(0.6\%$ of reading +5 LSD)

750 Volt range:

as above to 1 kHz

1 kHz to 10 kHz $\pm(1\%$ of reading +5 LSD)RESOLUTION: 10 μ V on 200 mV range

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.005\%$ of reading)/°C

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below.

INPUT IMPEDANCE: 1 M Ω shunted by < 100 pF

RESPONSE TIME: 3 seconds max. to rated accuracy

OVERLOAD:

750 V rms or 1100 V peak ac continuous.

Not to exceed 1×10^7 VHz product.AC CURRENT (True RMS Responding)RANGES: 200 μ A, 2 mA, 20 mA, 200 mA, and 2000 mA

RESOLUTION: 10 nA on 200 mA range.

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below.

ACCURACY:

1 year, 20 to 30°C

10% of full scale to full scale

30 Hz to 45 Hz $\pm(1\%$ of reading +5 LSD)45 Hz to 10 kHz $\pm(0.7\%$ of reading +5 LSD)2000 mA range limited to
1 kHz

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.03\%$ of reading)/°C

RESPONSE TIME: 3 seconds max. to rated accuracy.

OVERLOAD: Protected above 2A on all ranges by
circuit breaker. RESET on front panel. Limited
to 15A peak.DC CURRENTRANGES: ± 200 μ A, ± 2 mA, ± 20 mA, ± 200 mA, and
 ± 2000 mA.RESOLUTION: ± 10 nA on 200 μ A range

ACCURACY:

1 year, 20°C to 30°C

All ranges: $\pm(0.2\%$ of reading +3 LSD)

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.01\%$ of reading)/°COVERLOAD: Protected above 2A on all ranges by
resettable circuit breaker. Limited to 15A
peak.AC VOLTAGE (True RMS Responding)

RANGES: 200 mV, 2 V, 20 V, 200 V, 1200 Volts

TABLE 1-1. 3036A SPECIFICATIONS - Cont'd

RESISTANCE

RANGES: 200 Ω , 2 k Ω , 200 k Ω , 2000 k Ω , and 20 M Ω

RESOLUTIONS: 10 m Ω on 200 Ω range

ACCURACY:

1 year, 20 to 30°C

200 Ω to 2000 k Ω : $\pm(0.1\%$ of reading +3 LSD)

20 M Ω : $\pm(0.2\%$ of reading +3 LSD)

ZERO ADJUST: Front panel screwdriver adjustment for lead resistance compensation. Active only on lowest (200 Ω) range. Autozero on all other ranges.

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.01\%$ of reading)/°C

MAX. OPEN CIRCUIT VOLTAGE: 7 V

OVERLOAD PROTECTION:

± 285 V dc or ac peak continuous on any range.

RESPONSE TIME:

200 Ω to 2000 k Ω : 1 sec. max. to rated accuracy

20 M Ω : 4 sec. max. to rated accuracy

**MEASURING CONDITIONS ON
RESISTOR UNDER TEST:**

RANGE	CURRENT	VOLTAGE
200 Ω	1 mA	< 200 mV (LO)
2 K Ω	1 mA	< 2 V
20 K Ω	10 μ A	< 200 mV (LO)
200 K Ω	10 μ A	< 2 V
2000 K Ω	1 μ A	< 2 V
20 M Ω	100 nA	< 2 V

GENERAL**DISPLAY:**

Seven segment LED .43" character height.
Automatic decimal point polarity indicators.

OVERRANGE INDICATION: Flashing display.

BATTERY TEST: Battery condition will be displayed when DCV and 20 M Ω are pushed simultaneously.

DISPLAY TEST: Battery four digits, seven segment test when pushing both DCV and DCA.

MAXIMUM COMMON MODE VOLTAGE:

1000 $\pm$ (dc + peak ac) with battery operation.

500V $\pm$ (dc + peak ac) with ac accessory.

OPERATING TEMPERATURE: -10°C to 55°C.

HUMIDITY RANGE:

0 to 90% R.H.

0 to 85% R.H. above 45°C

Usable to 95% R.H.

POWER REQUIREMENTS:

DC, +9 to +14 volts; 300 mA.

AC Power with external power adapters; 10 VA:

Option 30: 103 to 127 V rms, 60 to 400 Hz

Option 31: 210 to 248 V rms, 50 to 400 Hz

Option 05: Internal rechargeable battery operation.

4 NiCad rechargeable "C" cell batteries.

14 hour recharge; 6 hours typical operation.

DIMENSIONS AND WEIGHTS:

Height: 62.7 mm (2.47 in.)

Width: 208.3 mm (8.20 in.);
with handle 240.3 mm (9.46 in.)

Depth: 229.1 mm (9.02 in.);
with handle 301.5 mm (11.87 in.)

Weight: 1.2 kg (2 lb. 7 oz.)
with batteries 1.85 kg (4 lbs. 1 oz.)

Shipping Weight: 2.94 kg (6.5 lbs.)

SUPPLIED ACCESSORIES:

1 AC Power Adapter Opt. 30 or Opt. 31

1 Instruction Manual

1 Probe Test Lead Kit, 4 feet, (red/black)
P/N 85-10062-0

TABLE 1-2. 3036B SPECIFICATIONS

DC VOLTAGERANGES: ± 200 mV, ± 2 V, ± 20 V, ± 200 V, ± 1200 VRESOLUTION: ± 10 μ V on 200 mV range

ACCURACY:

1 year, 20°C to 30°C

All ranges:

 $\pm(0.02\%$ of reading $\pm 0.02\%$ of full scale)

Short Term:

 $\pm(0.01\%$ of reading + 0.01% of full scale)INPUT IMPEDANCE: 10 M Ω all ranges

NORMAL MODE REJECTION:

>60 dB at DC, 50 Hz and 60 Hz

COMMON MODE REJECTION:

>120 dB at DC, 50 Hz and 60 Hz

(with 1 k Ω unbalance, common driven)

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.002\%$ of reading)/°C

ZERO STABILITY: Auto zeroed on all ranges

POLARITY: Automatic bipolar + or - display

OVERLOAD:

 ± 1200 V DC or 1200 V peak AC continuous

RESPONSE TIME: 1 second max. to rated accuracy

DC CURRENTRANGES: ± 200 μ A, ± 2 mA, ± 20 mA, ± 200 mA, and ± 2000 mARESOLUTION: ± 10 nA on 200 μ A range

ACCURACY:

1 year, 20 to 30°C

All ranges: $\pm(0.1\%$ of reading +3 LSD)

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges: $\pm(0.005\%$ of reading)/°C

OVERLOAD: Protected above 2A on all ranges by resettable circuit breaker. Limited to 15A peak.

AC VOLTAGE (True RMS Responding)

RANGES: 200 mV, 2 V, 20 V, 200 V, 1200 Volts

ACCURACY:

1 year, 20°C to 30°C

10% of full scale to full scale

30 Hz to 50 Hz

 $\pm(1\%$ of reading + 0.15% of full scale)

50 Hz to 10 kHz

 $\pm(0.2\%$ of reading + 0.15% of full scale)

10 kHz to 20 kHz

 $\pm(0.5\%$ of reading + 0.15% of full scale)

750 Volt range:

as above to 1 kHz

1 kHz to 10 kHz

 $\pm(1\%$ of reading + 0.15% of full scale)RESOLUTION: 10 μ V on 200 mV range

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges:

 $\pm(0.015\%$ of reading + 0.005% of full scale)/°C

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below

INPUT IMPEDANCE: 1 M Ω shunted by < 100 pF

RESPONSE TIME: 3 seconds max. to rated accuracy

OVERLOAD:

750 V rms or 1100 V peak AC continuous.

Not to exceed 1×10^7 VHz product.AC CURRENT (True RMS Responding)RANGES: 200 μ A, 2 mA, 20 mA, 200 mA, and 2000 mA

RESOLUTION: 10 nA on 200 mA range

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below

ACCURACY:

1 year, 20 to 30°C

10% of full scale to full scale

30 Hz to 50 Hz

 $\pm(1\%$ of reading +5 LSD)

50 Hz to 10 kHz

 $\pm(0.5\%$ of reading +5 LSD)

2000 mA range limited to 1 kHz

TEMPERATURE COEFFICIENT:

0 to 20°C and 30 to 50°C

All ranges:

 $\pm(0.3\%$ of reading + 0.002% of full scale)/°C

RESPONSE TIME: 3 seconds max. to rated accuracy

OVERLOAD: Protected above 2A on all ranges by circuit breaker. RESET on front panel. Limited to 15A peak.

TABLE 1-2. 3036B SPECIFICATIONS - Cont'd

RESISTANCE

RANGES: 200 Ω , 2 k Ω , 200 k Ω , 2000 k Ω and 20 M Ω

RESOLUTIONS: 10 M Ω on 200 Ω range

ACCURACY:

1 year, 20°C to 30°C

200 Ω to 200 k Ω

$\pm(0.02\%$ of reading + 0.03% of full scale)

200 k Ω to 20 M Ω

$\pm(0.07\%$ of reading + 0.03% of full scale)

ZERO ADJUST: Front panel screwdriver adjustment for test lead resistance compensation.

TEMPERATURE COEFFICIENT:

-40°C to 20°C and 30°C to 50°C

$\pm(0.008\%$ of reading + 0.001% of full scale)/°C

MAXIMUM OPEN CIRCUIT VOLTAGE: 5 V maximum

OVERLOAD PROTECTION:

± 285 V DC or AC peak continuous to any range

RESPONSE TIME:

200 Ω to 2000 k Ω : 1 sec. max. to rated accuracy

20 M Ω : 4 sec. max. to rated accuracy

MEASURING CONDITIONS ON
RESISTOR UNDER TEST:

RANGE	CURRENT	VOLTAGE
200 Ω	1 mA	< 200 mV (LO)
2 k Ω	1 mA	< 2 V
20 k Ω	10 μ A	< 200 mV (LO)
200 k Ω	10 μ A	< 2 V
2000 k Ω	1 μ A	< 2 V
20 M Ω	100 nA	< 2 V

The 200 Ω and 20 k Ω ranges may be used for in-circuit resistance checks; while all other ranges may be used for semiconductor and diode checks.

GENERAL

DISPLAY:

Seven segment LED .43" character height.

Automatic decimal point and polarity indicators.

OVERRANGE INDICATION: Flashing display.

BATTERY TEST: Battery condition will be displayed when DCV and 20 M Ω are pushed simultaneously.

DISPLAY TEST: Four digits, seven segment test when pushing both DCV and DCA.

MAXIMUM COMMON MODE VOLTAGE:

500 V $\pm$ (dc + peak ac) with ac accessory.

1000 V $\pm$ (dc + peak ac) with internal batteries.

OPERATING TEMPERATURE: -10°C to 55°C

HUMIDITY RANGE:

0 to 90% R.H.

0 to 85% R.H. above 45°C

Usable to 95% R.H.

POWER REQUIREMENTS:

DC, +9 to +14 volts; 300 mA.

AC Power with external power adapters; 10 VA:

Option 30: 103 to 127 V rms, 60 to 600 Hz

Option 31: 210 to 248 V rms, 50 to 400 Hz

Option 05: Internal rechargeable battery operation.

4 NiCad rechargeable "C" cell batteries.

14 hour recharge; 6 hours typical operation.

DIMENSIONS AND WEIGHT:

Height: 62.7 mm (2.47 in.)

Width: 208.3 mm (8.20 in.);
with handle 240.3 mm (9.46 in.)

Depth: 229.1 mm (9.02 in.);
with handle 301.5 mm (11.87 in.)

Weight: 1.2 kg (2 lbs. 7 oz.)
with batteries 1.85 kg (4 lbs. 1 oz.)

Shipping Weight: 2.94 kg (6.5 lbs.)

SUPPLIED ACCESSORIES:

1 AC Power Adapter Opt. 30 or Opt. 31

1 Instruction Manual

1 Probe Test Lead Kit, 4 feet, (red/black)

P/N 85-10062-0

TABLE 1-3. 3036B-968 SPECIFICATIONS

DC VOLTAGE

RANGES: ± 200 mV, ± 2 V, ± 20 V, ± 200 V, ± 1200 V

RESOLUTION: ± 10 μ V on 200 mV range

ACCURACY:

1 year, 20 to 30°C

All ranges:

$\pm(0.02\%$ of reading + 0.02% of full scale)

Short Term:

$\pm(0.01\%$ of reading + 0.01% of full scale)

INPUT IMPEDANCE: 10 M Ω all ranges

NORMAL MODE REJECTION:

>60 dB at DC, 50 Hz and 60 Hz

COMMON MODE REJECTION:

>120 dB at DC, 50 Hz and 60 Hz

(with 1 k Ω unbalance, common driven)

TEMPERATURE COEFFICIENT:

-40°C to 20°C and 30°C to 50°C

$\pm(.0045\%$ of reading + 0.001% of full scale)/°C

ZERO STABILITY: Auto zeroed on all ranges

POLARITY: Automatic bipolar + or - display

OVERLOAD:

± 1200 V DC or 1700 V peak AC continuous

RESPONSE TIME: 1 second max. to rated accuracy

DC CURRENT

RANGES: ± 200 μ A, ± 2 mA, ± 20 mA, ± 200 mA, and ± 2000 mA.

RESOLUTION: ± 10 nA on 200 μ A range

ACCURACY:

1 year, 20°C to 30°C

All ranges: $\pm(0.1\%$ of reading + 3 LSD)

TEMPERATURE COEFFICIENT:

-40°C to 20°C and 30°C to 50°C

$\pm(0.004\%$ of reading + 0.002% of full scale)/°C

OVERLOAD: Protected above 2A on all ranges by resettable circuit breaker. Limited to 15A peak.

AC VOLTAGE (True RMS Responding)

RANGES: 200 mV, 2 V, 20 V, 200 V, 1200 V

ACCURACY:

50 Hz to 10 kHz

$\pm(0.2\%$ of reading + 0.15% of full scale)

10 kHz to 20 kHz

$\pm(0.5\%$ of reading + 0.15% of full scale)

RESOLUTION: 10 μ V on 200 mV range

TEMPERATURE COEFFICIENT:

$\pm(0.015\%$ of reading + 0.005% of full scale)/°C

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below.

INPUT IMPEDANCE: 1 M Ω shunted by <100 pF

RESPONSE TIME: 3 seconds max. to rated accuracy

OVERLOAD: ± 500 V dc and 1000 V rms (sinusoidal)

AC CURRENT (True RMS Responding)

RANGES: 200 μ A, 2 mA, 20 mA, 200 mA, and 2000 mA

RESOLUTION: 10 nA on 200 mA range

CREST FACTOR:

5 at full range (19,999 counts)

10 at 1/2 range (10,000 counts) and below

ACCURACY:

1 year, 20°C to 30°C

All ranges above 200 counts

30 Hz to 100 Hz $\pm(1\%$ of reading + 5 LSD)

100 Hz to 10 kHz $\pm(0.5\%$ of reading + 5 LSD)

2000 mA range limited to 1 kHz

TEMPERATURE COEFFICIENT:

-40°C to 20°C and 30°C to 50°C

$\pm(0.03\%$ of reading + .002% of full scale)/°C

RESPONSE TIME: 3 seconds max. to rated accuracy.

OVERLOAD: Protected above 2A on all ranges by circuit breaker with RESET on front panel. Limited to 15A peak.

RESISTANCE

RANGES: 200 Ω , 2 k Ω , 200 k Ω , 2000 k Ω , and 20 M Ω

RESOLUTIONS: 10 M Ω on 200 Ω range

TABLE 1-3. 3036B-968 SPECIFICATIONS - Cont'd

ACCURACY:

1 year, 20°C to 30°C

200 Ω to 200 k Ω $\pm(0.02\%$ of reading + 0.03% of full scale)200 k Ω to 20 M Ω $\pm(0.07\%$ of reading + 0.03% of full scale)**ZERO ADJUST:** Front panel screwdriver adjustment for test lead resistance compensation.**TEMPERATURE COEFFICIENT:**

-40°C to 20°C and 30°C to 50°C

 $\pm(0.008\%$ of reading + 0.001% of full scale)/°C**MAXIMUM OPEN CIRCUIT VOLTAGE:** 5 V maximum**OVERLOAD PROTECTION:** ± 285 V DC or AC peak continuous on any range**RESPONSE TIME:**200 Ω to 2000 k Ω : 1 sec. max. to rated accuracy20 M Ω : 4 sec. max. to rated accuracy**MEASURING CONDITIONS ON
RESISTOR UNDER TEST:**

RANGE	CURRENT	VOLTAGE
200 Ω	1 mA	< 200 mV (LO)
2 K Ω	1 mA	< 2 V
20 K Ω	10 μ A	< 200 mV (LO)
200 K Ω	10 μ A	< 2 V
2000 K Ω	1 μ A	< 2 V
20 M Ω	100 nA	< 2 V

The 200 Ω and 20 k Ω ranges may be used for in-circuit resistance checks; while all other ranges may be used for semiconductor and diode checks.

GENERAL**DISPLAY:**

Seven segment LED .43" character height.

Automatic decimal point and polarity indicators.

OVERRANGE INDICATION: Flashing display**BATTERY TEST:** Battery condition will be displayed when DCV and 20 M Ω are pushed simultaneously.**DISPLAY TEST:** Four digits, seven segment test when pushing DCV and DCA.**MAXIMUM COMMON MODE VOLTAGE:**
 ± 500 V (dc + peak ac)**ENVIRONMENTAL****OPERATING TEMPERATURE:**

AC Mains powered - 40°C to + 55°C
Internal Battery 0 to 50°C

STORAGE:

With Batteries - 40°C to 60°C
Without Batteries - 55°C to 75°C

SHOCK, VIBRATION, BENCH HANDLING:

MIL-T-28800, Class 2

EMI:

MIL-T-28800, Class 3

Combination Case

Enclosure and Cover: MIL-T-28800, Class 2, Style A

HUMIDITY:

(without condensation) MIL-T-28800, Class 3
0 to 90% R.H.
0 to 85% R.H. above 40°C
Usable to 95% R.H.

POWER REQUIREMENTS

100/120/220/240 Volts AC, 50 to 400 Hz
10 VA maximum

Internal NiCad Rechargeable Battery:

Operation for 8 hours at room temperature
Recharge fully in 14 hours

SIZE

Width: 267 mm (10 1/2 in.)
Width Overall: 283 mm (11 1/8 in.)

Height: 102 mm (4 in.)
Height Overall: 125 mm (4 15/16 in.)

Length: 264 mm (10 3/8 in.)
Length Overall: 282 mm (11 3/32 in.)
Length Overall with Cover: 318 mm (12 1/2 in.)

WEIGHT

3.75 kg (8 lbs. 4 oz.).

SHIPPING WEIGHT

5.1 kg (11 lbs. 4 oz.)

ACCESSORIES SUPPLIED

1 each AC Mains Power Cable P/N 89-10414-1A
1 each Safety Test Lead Set (red/black)
1 each Instruction Manual
1 each Shorting Link (Common to Case)

TABLE 1-4. ACCESSORIES

Model	Description
10800B/C	40 kV, HV DC Probe
1301B	10 kV, HV AC Probe
10850B	RF Probe, 100 kHz to 700 MHz
12851A	HV RF Probe Kit to 500 V and 1 GHz
10860A	Current Probe, AC, Clamp on to 1000 A
10861A	Current Probe, AC, Clamp on to 150 A
10801B	Test Lead Kit, 4 probes
10731A	Carrying Case, molded plastic (3036A/B only)
606	Shunt, AC/DC, 20 Amps (0.01 Ohms)
10751A	Front Panel Dust Cover (3036A/B only)
800-09	Rack Mount Kit, left or right (one instrument) (3036A/B only)
800-10	Rack Mount Kits, side-by-side (two instruments) (3036A/B only)
12616A	Adapter, Shielded, double banana to BNC female
12617A	Adapter, double banana to BNC female
12249D	Cable, BNC to BNC Shielded cable, 4 feet
12250D	Cable, BNC to alligator clips, 4 feet
12251D	Cable, double banana to BNC, 4 feet
12252D	Cable, Shielded, double banana to test probe
89-10422-1	Battery Replacement Kit for 3036A/B only
89-11262-1	Battery Replacement Kit for 3036B-968 only

TABLE 1-5. OPTIONS*

Options		Factory Installed	Field Installed
01	Parallel BCD Printer Output	YES	NO
05	Internal Rechargeable Battery Pack with charger. 14 hour charge, 6 hour operation	YES	YES
21	20 Ampere Current Range	YES	NO
30	120 V AC Adapter 60 to 400 Hz	YES	YES
31	230 V AC Adapter 50 to 400 Hz	YES	YES

*Only Option 21 is applicable to the 3036B-968

TABLE 1-6. OPTION INCOMPATIBILITY

Option	01	05	21	30	31	MOD 968
01	-	N	Y	Y	Y	N/A
05	N	-	Y	Y	Y	Included
21	Y	Y	-	Y	Y	Y
30	Y	Y	Y	-	N	N/A
31	Y	Y	Y	N	-	N/A

- = Not Applicable N = Not Compatible Y = Compatible

SECTION 2

INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information and instructions necessary for the installation and shipping of the instrument. Details are provided for initial inspection, power connections, grounding safety requirements, installation information, and repacking instructions for storage or shipment.

2-3. UNPACKING AND INITIAL INSPECTION

2-4. Unpacking and initial inspection of the instrument requires only the normal precautions and procedures applicable to the handling of sensitive electronic equipment. The contents of all shipping containers should be checked for included accessories and certified against the packing slip to ascertain that the shipment is complete.

2-5. PERFORMANCE CHECKS

2-6. This instrument was carefully inspected for mechanical and electrical performance before shipment from the factory. It should be free of physical defects and in perfect electrical order upon receipt. Check the instrument for possible damage incurred in transit and, if necessary, complete the performance checks outlined in paragraphs 5-7 through 5-30. If there is any indication of damage or improper operation, refer to the warranty included in this manual and notify your local Ballantine field engineering representative or the factory.

2-7. SAFETY CONSIDERATIONS

2-8. See Table 2-1 for the basic applicable safety requirements.

2-9. ALWAYS observe these safety considerations and cautions. Read and understand all of this manual for operational considerations and operator safety.

2-10. POWER REQUIREMENTS - 3036A/B ONLY

See paragraph 2-17 for 3036B-968 power requirements.

2-11. These instruments may be operated from an external dc power source, from ac mains through Ballantine power converters and from internal rechargeable batteries.

2-12. DC POWER OPERATION

2-13. These instruments are designed to operate from 9 to 14 volts dc. AC operation is available through optional Power Adapters. A rear panel mounted five-pin locking DIN receptacle is provided for connecting 9 to 14 volts dc at nominally 300 mA. The DC power negative polarity is at rear panel and COMMON connector potential. When using dc power input, a diode protects the instrument against accidental polarity reversal. A dc power fuse is located within the instrument case. The 3036A/B can not be floated "off battery" when using dc power operation.

2-14. Operation above 14 volts is permitted when a power resistor is connected in series with the positive dc power input lead. This power resistor must be rated at nominally 1.6 ohm per volt of drop above the first 10 volts of dc power input voltage. As an example, a +28 volt dc supply, which may rise to +32 volts, should have a 22 volt drop in the series power resistor (32 volts - 10 volts). Use a 33 to 36 ohm, 20 watt resistor for this dc input. Do not exceed 14 volts input without the series resistor since the instrument may be damaged and the warranty voided.

2-15. AC POWER MAINS OPERATION, OPTION 30 (120 V) and Option 31 (230 V)

2-16. AC power operation is available by the use of an optional ac power adapter which converts ac power to nominally 9.4 volts dc. P/N 85100691 (Option 30) is the 120 volt (103 to 126 V) ac rms adapter operating from 60 Hz to 400 Hz input power frequency. This adapter is a wall mount type which mates directly with American wall power receptacles and includes a third pin ground pin. The ground is provided for safety purposes and should be used at all times. When using the ac adapters, the COMMON input terminal may be floated to a maximum of ± 500 V (dc + ac peak) with respect to earth ground. The adapter contains all ac power voltages and only low voltage dc is found in the instrument and the connecting power input cabling. This assures optimum operator safety and follows the safety requirements set forth by UL and O.S.H.A. Power Adapter P/N 85100701 (Option 31) is optionally available for 230 V ac rms (210 to 248 V) 50 Hz to 400 Hz ac power mains input. This unit is a bench mount type with a three wire input cable ready for installation of European type power mains plug.

TABLE 2-1.

SAFETY CONSIDERATIONS

GENERAL

This is a Safety Class 1 instrument. This instrument has been designed considering IEC Publication 348 and ANSCI C39.5, "Safety Requirements for Electronic Measuring Apparatus".

This manual contains information, cautions, and warnings which must be followed by the service person to ensure safe operation and to retain the instrument in safe condition.

WARNINGS

SAFETY

If this instrument is to be energized via an autotransformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

GROUNDING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal is likely to make this instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

Warning - These servicing instructions are for use by qualified personnel only. To avoid dangerous electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

CAUTIONS

LINE VOLTAGE SELECTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source. Verify that the power transformer primary is matched to the available line voltage. Verify that the correct fuse is installed.

GROUNDING

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)



ATTENTION



This symbol: , which appears on the instrument means: Read the instruction manual before operating the instrument. If the instrument is operated without reading the instructions, it may not operate correctly.

CAUTION

The ac power adapters for this instrument are provided with a three-conductor power cord which will ground the case when connected to a three-conductor grounding outlet. If a grounding outlet is not available, an adapter must be used which provides a good grounding connection. If batteries or dc input power are used, the case should be properly grounded to an earth ground. Failure to use proper grounding may cause personnel hazard when the instrument is used with other electrical equipment.

2-17. POWER REQUIREMENTS - 3036B-968

2-18. The 3036B-968 may be operated from any one of the following AC mains power sources:

- a. 88 to 110 volts (100 volts nominal)
- b. 103 to 132 volts (112 volts nominal)
- c. 196 to 242 volts (220 volts nominal)
- d. 210 to 264 volts (240 volts nominal)

A screwdriver activated selector switch for nominal mains voltage is located on the front panel. Always disconnect the power mains before switching the mains voltage selector switch. 50 to 400 Hz mains frequency range is applicable to the 3036B-968.

CAUTION

Failure to switch the 3036B-968 to match the mains voltage and to switch with the mains cable disconnected may damage the instrument and void the warranty.

2-19. The instrument should be operated from an ac power source with its neutral at or near ground (earth) potential. The instrument is not intended for operation from two phases of a multiphase ac system across the legs of a single-phase, three-wire ac power system. Crest factor (ratio of peak voltage to rms) should be typically within the range of 1.3 to 1.6 at $\pm 10\%$ of the nominal rms line voltage. Use a true rms responding voltmeter, such as the Ballantine Model 3620A, to measure the power line voltage.

WARNING

The instrument is provided with a three-conductor power cord which will ground the case when connected to a three-conductor grounding outlet. If a grounding outlet is not available, an adapter must be used which provides a good grounding connection.

2-20. BATTERY OPERATION

2-21. The instrument may be operated from rechargeable nickel-cadmium batteries. The battery charger is standard in all instruments. Internal batteries are optional with the 3036A/B and supplied with the 3036B-968.

2-22. The built-in charger provides full charge with POWER switch OFF and instrument power connected, or trickle-charge with POWER switch ON. The instrument may be operated from the ac or dc source with or without batteries installed. Always fully charge batteries for 14 hours after shipment or storage. Periodically discharge batteries by operating the instrument until the battery check voltage drops below a 5 volt display indication. Then fully recharge batteries overnight with POWER switch OFF. This assures that NiCad batteries do not get a partial recharge deactivation which will limit instrument operating time and battery life.

2-23. Charge condition of internal batteries can be checked by removing power input and by simultaneously pushing the 20 Megohm and DCV push-buttons. Display reading should be above 5 volts or the batteries must be charged. Full re-charge will be obtained by applying ac power in the power OFF position for 14 hours.

2-24. GROUNDING REQUIREMENTS

2-25. To insure the safety of operating personnel, the U.S. Occupational Safety and Health Act (OSHA) and good engineering practice require that the instrument panel and enclosure be "earth grounded". All Ballantine instruments are provided with a three-conductor power cable assembly which, when plugged into an appropriate power receptacle, grounds the instrument. The offset pin on the male end of the power cable is the ground wire connection to the connector on the rear panel of the instrument.

2-26. To preserve the safety protection feature, when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead or terminal on the adapter to "earth ground".

WARNING

When using the instrument on external dc power or battery operation, use caution to avoid electrical shock and connect the instrument case to earth ground through the rear-panel grounding lug on the 3036A/B or the case ground binding post on the front panel of the 3036B-968.

2-27. INSTALLATION AND MOUNTING

2-28. The instrument is fully solid-state and dissipates minimal heat. No special cooling is required. However, the instrument should not be operated where the ambient temperature exceeds 55°C (131°) or when condensation due to high relative humidity appears anywhere on the instrument. The instrument is shipped ready for use as a portable or bench instrument. Outline dimensions are shown in Figure 2-1 for the 3036A/B and Figure 2-3 for the 3036B-968.

NOTE

Before using the instrument, exercise each of the pushbutton switches six or more times. This wiping action cleans switch contacts which may become noisy or intermittent during periods of storage or in contaminating environments.

Always recharge internal NiCad batteries for 14 hours before putting the instrument in service.

2-29. The 3036A/B case is provided with a carry handle which also serves as a tilt stand. To change the position of the handle, simply pull both sides of the handle outward from the case to disengage the detent mechanism; then, rotate the handle to the desired position, push the handle back toward the case and rotate slightly until it detents in place. The 3036B-968 combination case cover may be used to raise the case for easy viewing or the cover can be separated from the case by disengaging the slip hinges.

2-30. Rack mounting capability for the 3036A/B is provided by a rack adapter panel. Three 19-inch EIA rackmount configurations are available and listed in Table 1-3. See Figure 2-2 for outline drawings.

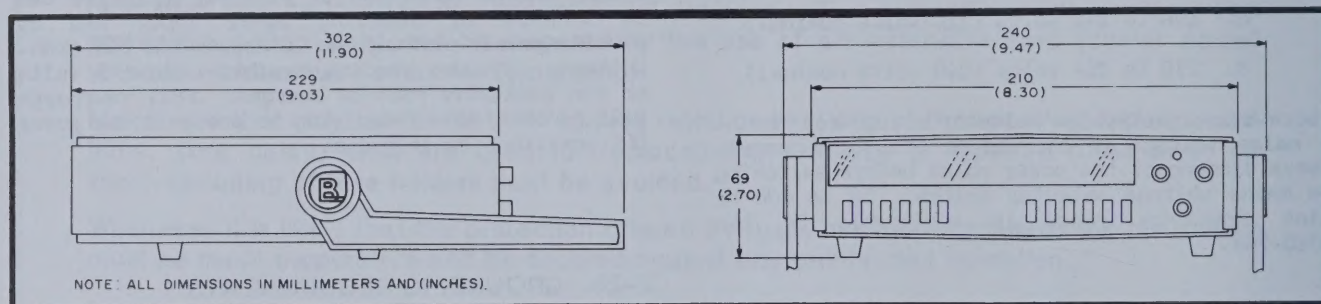


Figure 2-1. Model 3036A/B, Outline Dimensions

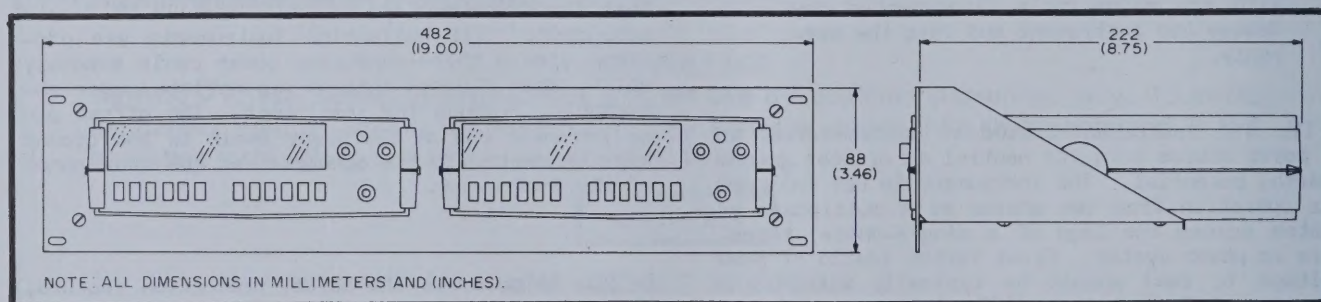


Figure 2-2. Model 3036A/B Rack Mount, Outline Dimensions

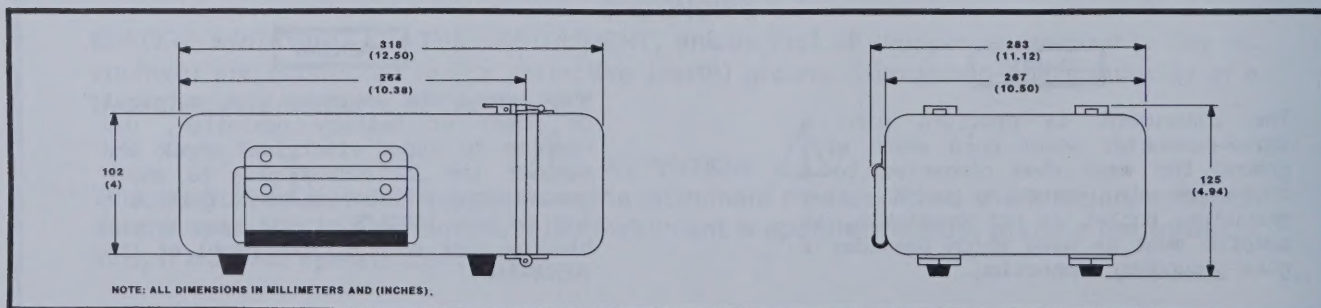


Figure 2-3. Model 3036B-968, Outline Dimensions

2-31. REPACKAGING FOR SHIPMENT

2-32. If the instrument is to be repackaged for shipment, as a general guide, repackage the instrument as described in the following procedure and shown in Figure 2-4. Use either the original packing material, if available, or material similar to that specified. Proceed as follows:

- a. Place the instrument accessories, if any, in a plastic bag and seal the bag.

NOTE

It is recommended that the NiCad batteries be removed from the instrument if extreme environments or storage in excess of twelve months is anticipated.

- b. For long distance shipping only, use U.S. Government packaging method IIC and tape a two-unit bag of dessicant (MIL-D-3464) on the rear of the enclosure.

- c. Place a piece of sturdy cardboard over the front panel for protection. Enclose the instrument in a plastic bag and seal the bag.

- d. Wrap the bagged instrument and accessories in 1-inch thick, flexible, cellular plastic-

film, cushioning material (PP-B-795) and place in a barrier bag (MIL-B-131). Extract the air from the bag and heat seal.

- e. Place the wrapped instrument and accessories into a fiberboard box (PPP-B-636) of suitable size. Fill spaces with rubberized hair or cellular plastic cushioning material. Close box in accordance with container specifications. Seal with sturdy water-resistant tape or with metal straps.

- f. Mark contained "FRAGILE", "HANDLE WITH CARE", or similar precautionary notice. Affix shipping labels as required or mark according to MIL-STD-129.

NOTE

If the instrument is to be shipped to Ballantine for calibration or repair, attach a tag to the instrument identifying the owner. Note the problem, the symptoms, and service or repair desired. Record the model and serial number of the instrument. Show the work authorization order as well as the date and method of shipment. Always obtain a RETURN AUTHORIZATION from the factory before shipping the instrument.

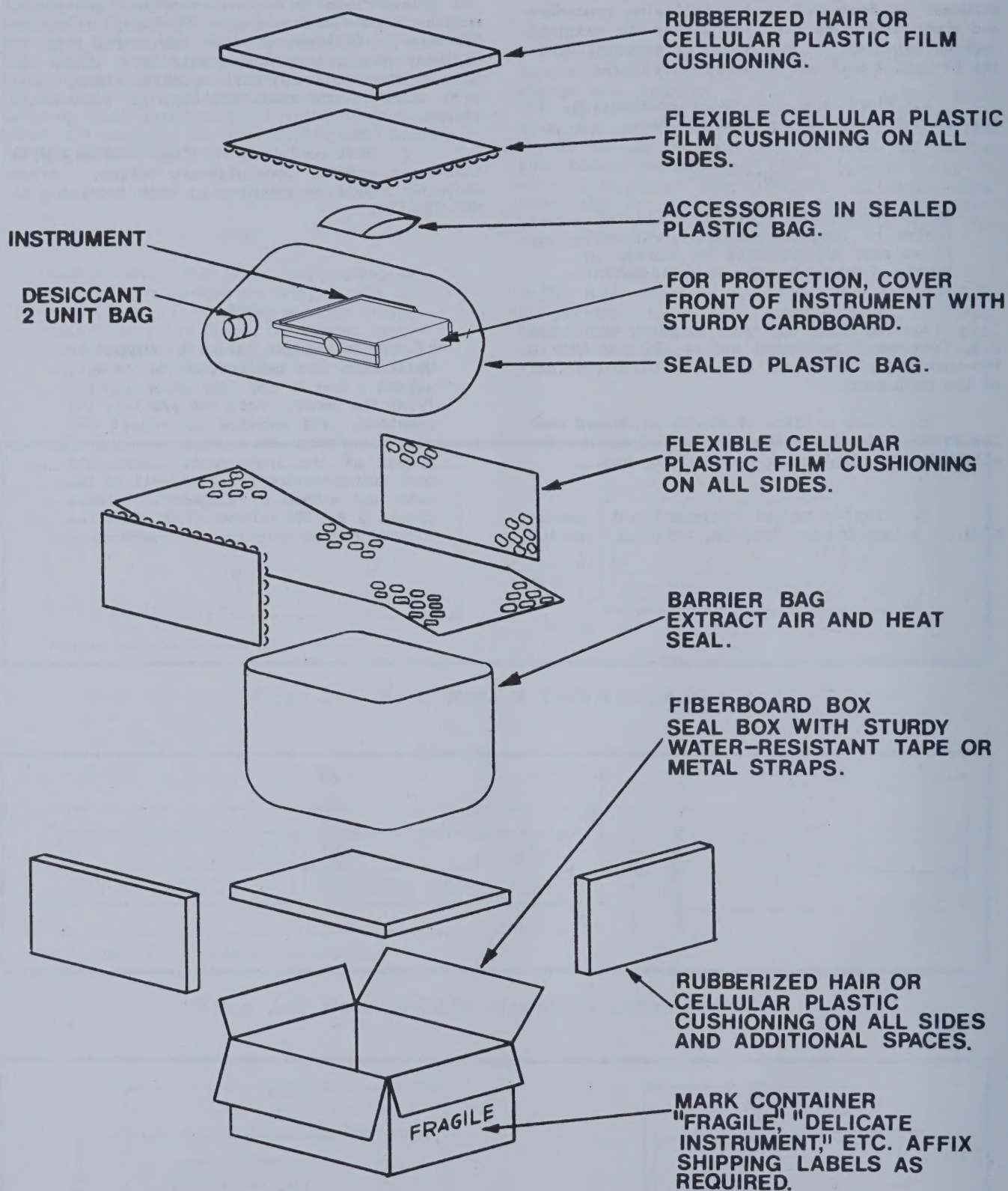


Figure 2-4. Packing Diagram

SECTION 3

OPERATION

3-1. INTRODUCTION

3-2. This section contains instructions and information required for the operation of the instrument. Included are identification of controls, connectors, options and indicators.

3-3. CONTROLS, INDICATORS, AND CONNECTORS

3-4. The controls, indicators, and connectors are identified in Figure 3-1 and Table 3-1.

3-5. POWER REQUIREMENTS (AC, DC, AND INTERNAL BATTERY)

3-6. See paragraphs 2-10 through 2-23. For grounding and safety earth connections see paragraphs 2-24 through 2-26.

3-7. OPERATING INSTRUCTIONS

3-8. Figures 3-2 through 3-7 outline instructions for making measurements. Each figure discusses a particular mode of operation. The number associated with each control indicates the step in which the control is being used. Front panel controls and indicator functions of the 3036A/B and the 3036B-968 are similar so that operating instructions apply to all units.

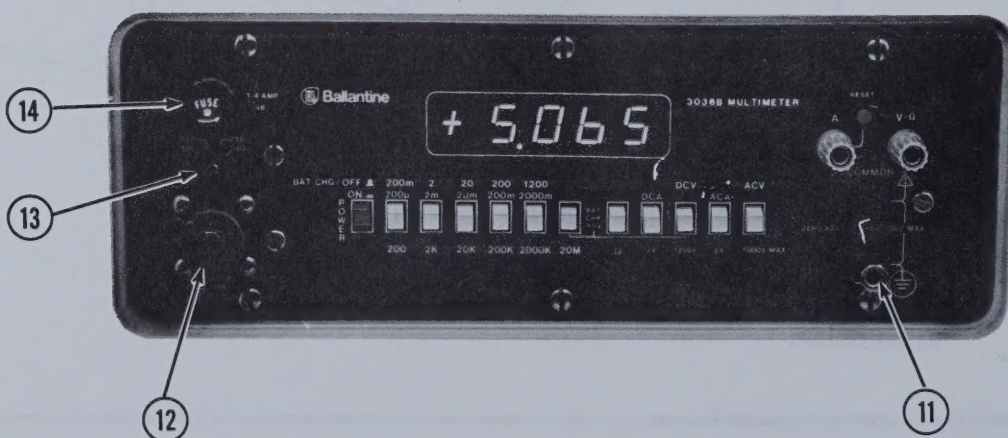
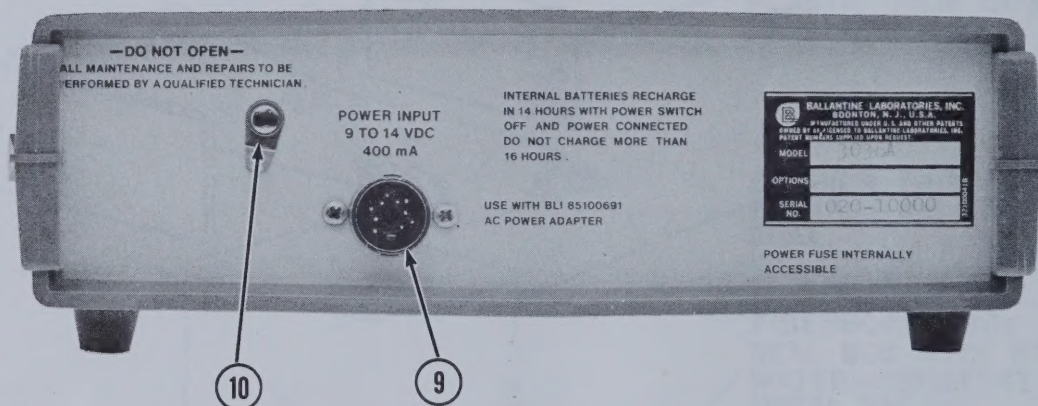
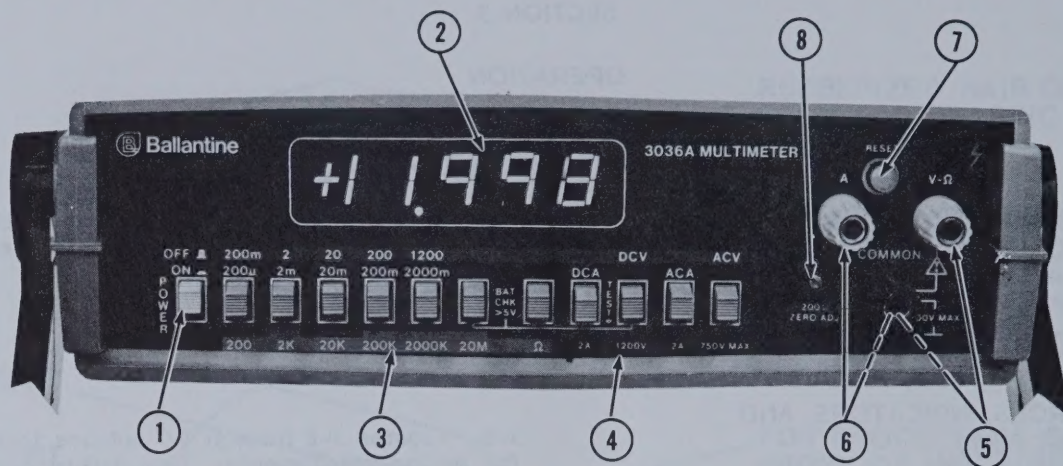


Figure 3-1. Controls, Connectors and Indicators

TABLE 3-1. MODEL 3036A/B/968, CONTROLS, INDICATORS, AND CONNECTORS

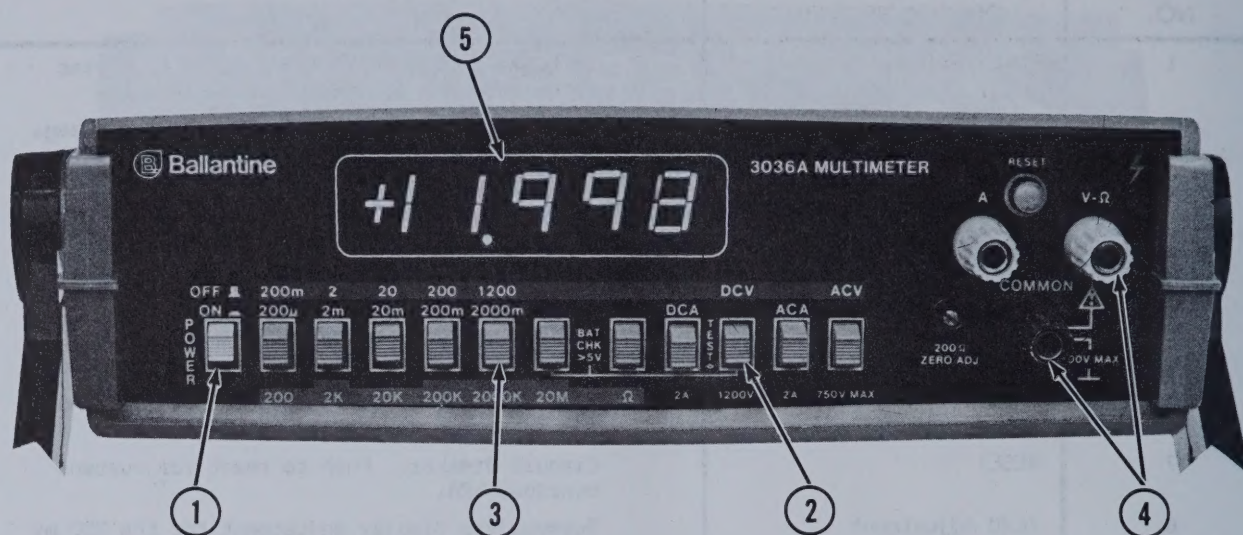
INDEX NO.	CONTROLS, INDICATORS OR CONNECTORS	DESCRIPTION
1	POWER Switch	Switches instrument power ON or OFF. Power is ON when the pushbutton is depressed.
2	Display	Digital readout, 5 sections. Four seven-segment LED's and 1, plus a polarity indicator.
3	RANGE Switches	Select one of five voltage ranges and one of six current or resistance ranges.
4	FUNCTION Switches	Select one of five measurement functions; ACV, DCV, DCA and Kohm.
5	VOLT-OHM Input Terminals	Used in conjunction with the COMMON terminal for measuring ac voltage, dc voltage or ohms.
6	A Terminal	Used in conjunction with the COMMON terminal for measuring ac or dc current.
7	RESET	Circuit Breaker. Push to reset for current overload >2A.
8	ZERO Adjustment	Screwdriver display adjustment for the 200 mV and 200 ohm ranges.
9**	Power Receptacle	5 pin DIN locking receptacle for power input of 9 to 14 volts dc.
10	Ground Lug	Ground connection to case.
11*	Ground Binding Post	Ground connection to case.
12*	AC Mains Power Receptacle	3 pin MS3102A-10SL-3P receptacle for AC mains power and earth ground.
13*	100/120/220/240	AC mains voltage selector switch.
14*	Fuse	AC mains fuse 1/4 Amp SLO-BLO.

*3036B-968 only

**3036A/B only

TABLE 3-2. MODEL 3036A/B MAXIMUM ALLOWABLE INPUT OVERLOAD CONDITIONS

SELECTED FUNCTION	SELECTED RANGE	MEASUREMENT INPUT CONNECTION	MAXIMUM INPUT OVERLOAD LIMITS
DCV	200 mV, 2, 20, 200, or 1200 V	V- Ω and COMMON	± 1200 V dc or 1000 V ac rms (sinusoidal)
ACV	200 mV, 2, 20, 200, or 1200 V	V- Ω and COMMON	750 V rms (1000 V rms 3036B-968) (sinusoidal) not to exceed 10^7 V-Hz
DCA, ACA	200 μ A, 2, 20, 200, or 2000 mA	A and COMMON	2A (circuit breaker protected). 15A peak maximum current. 250 V maximum ($\pm$ DC or AC RMS) open circuit voltage.
K Ω	200 Ω , 2, 20, 200, 2000 K Ω or 20 M Ω	V- Ω and COMMON	285 V rms
Any	Any	Earth Ground and COMMON	AC Mains Operation: Opt. 30, 31 and 3036B-968 500 V $\pm$ (DC + peak AC) Internal Battery Off Line Operation: 1000 V $\pm$ (DC + peak AC)



1. Set POWER switch to ON.
2. Set FUNCTION switch to DCV.
3. Set RANGE switch to 1200 or the desired lower range if known.
4. Connect unknown DC Voltage across V- Ω and COMMON terminals. Reduce range until proper reading is reached.
5. Read voltage on display. Decimal point is correctly positioned.

NOTE

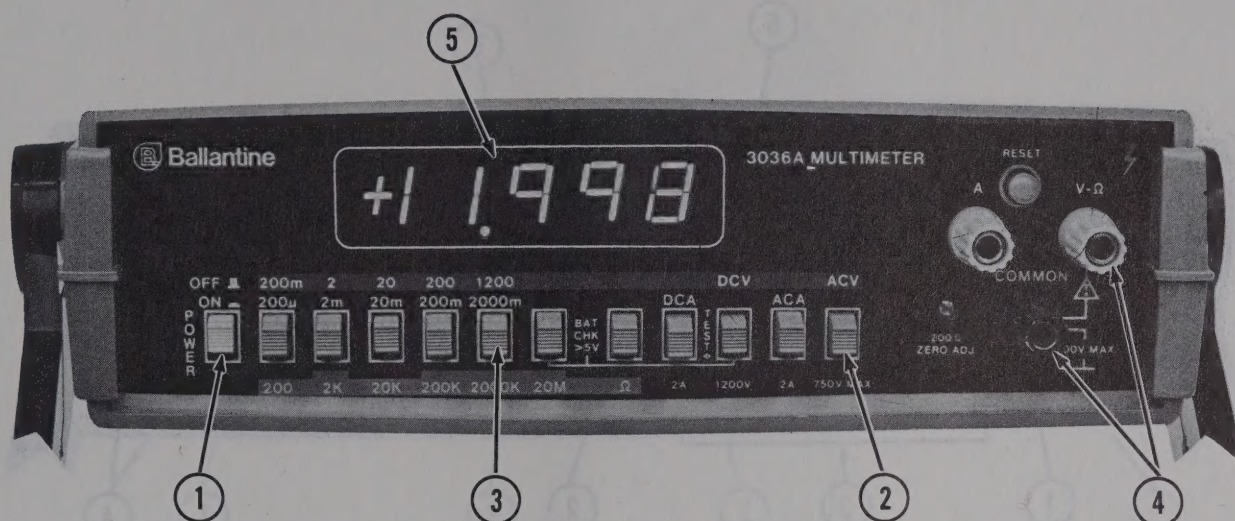
A flashing display indicates overload. Switch the appropriate range switch to the next higher range until a steady display appears.

Unit may be used up to 50% overrange on all ranges but not to exceed 1200 V. For example, 230 V would be displayed as 30.00 on the 200 V range with a flashing display.

CAUTION

The measuring circuit is floated from the enclosure ground of the instrument. The potential applied between COMMON and ground must not exceed 500 V $\pm$ (dc + peak ac) when using ac power adapters or the 3036B-968 or damage to the instrument may result.

Figure 3-2. DC Voltage Measurements



1. Set POWER switch to ON.
2. Set FUNCTION switch to ACV.
3. Set RANGE switch to 1200 or the desired lower range if known.
4. Connect unknown AC voltage across V- Ω and COMMON terminals. Reduce range switch until proper reading is reached.
5. Read voltage on display. Decimal point is correctly positioned.

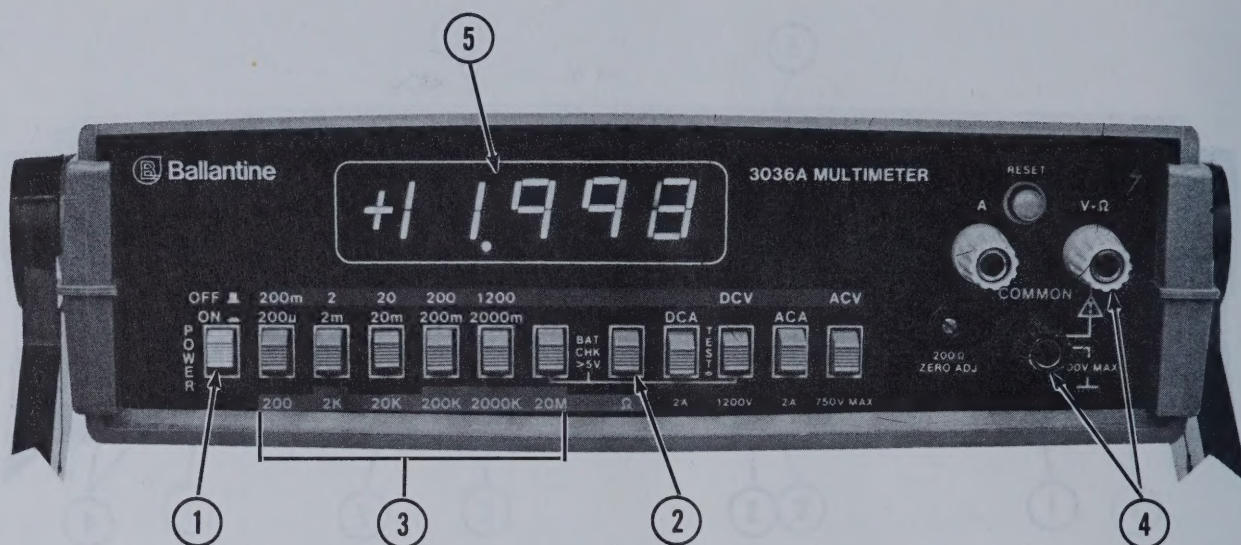
CAUTION

Maximum allowable input voltage is frequency dependent. Do not exceed 10^7 V-Hz product. Do not exceed 750 V rms (sinusoidal) on the 3036A/B or 1000 V rms on the 3036B-968.

NOTE

A flashing display indicates overload. Switch to the next higher range until a steady display appears. Avoid AC Volt readings when display reads below 10% of full scale.

Figure 3-3. AC Voltage Measurements



1. Set POWER switch to ON.
2. Set FUNCTION switch to Ω .
3. Set RANGE switch to the desired range.
4. Connect unknown resistance across V- Ω and COMMON terminals. Select range switch until proper reading is reached.
5. Read resistance on display. Decimal point is automatically positioned.

CAUTION

The resistance measuring circuitry is protected against the application of voltages of up to 285 volts $\pm$ (dc + peak ac). Voltage in excess of 285 V will damage the instrument. Always turn off power from the circuit being measured when making "in circuit" resistance measurements.

NOTES

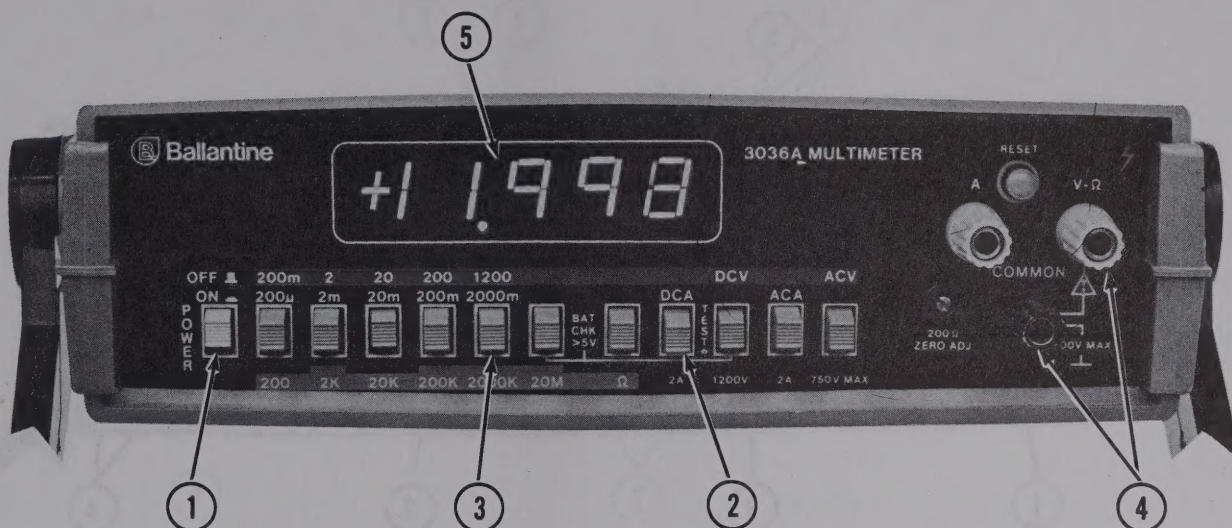
1. When using the 200 ohm range for low resistance measurements, the resistance of the multimeter leads will

cause error of about 0.2 ohm. Subtract this error from the reading or adjust the 200 ohm range ZERO screwdriver adjust on the front panel for a display of 00.00 when the test leads are firmly shorted together.

2. Flashing display indicates that the resistance to be measured is higher than the range selected. Switch to the next higher range until a steady display appears.

Unit may be used up to 50% overrange on all ranges. For example, 250 kilohms would be displayed as 50.00 on the 200 kilohm range with a flashing display.

Figure 3-4. Resistance Measurements



1. Set POWER switch to ON.
2. Set FUNCTION switch to DCA.
3. Set RANGE switch to 2000 m or the desired lower range if known.
4. Connect unknown dc current across A and COMMON terminals. Reduce range switch until proper reading is reached.
5. Read dc current on the display. Decimal point is correctly positioned and polarity automatically indicated.

NOTE

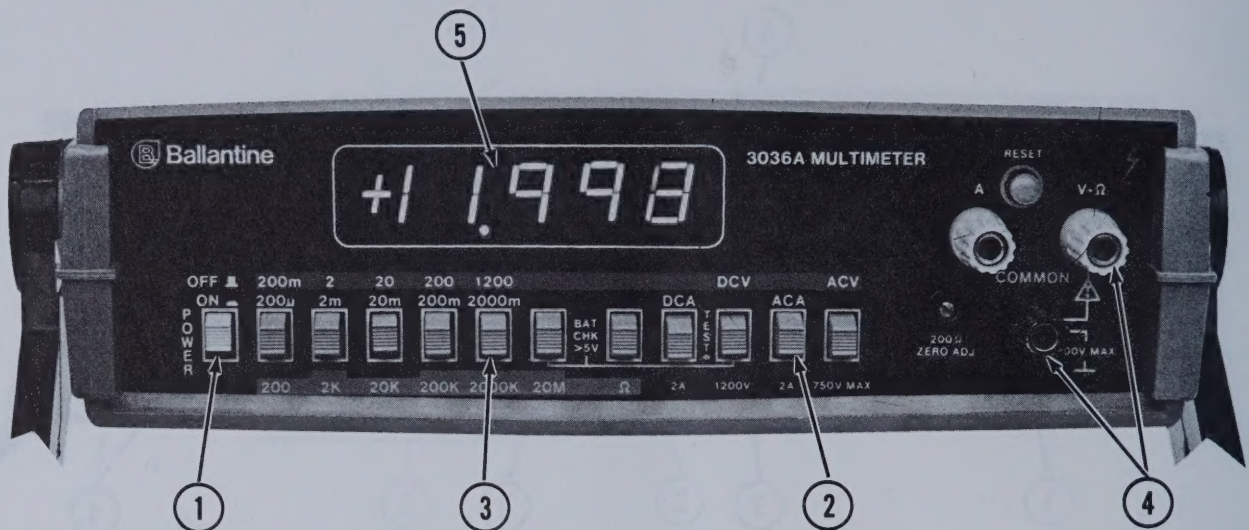
A flashing display indicates overload. Switch to the next higher range until a steady display appears.

Unit may be used up to 50% overrange on all ranges but not to exceed 2 A. For example, 250 mA would be displayed as 50.00 on the 200 mA range with a flashing display.

CAUTION

A current in excess of 2 A, applied across the A and COMMON terminals will trip the circuit breaker. If the breaker trips, its reset button will extend farther from the panel. To reset, simply push the RESET button. DO NOT apply peak current exceeding 15 Amperes.

Figure 3-5. DC Current Measurements



1. Set POWER switch to ON.
2. Set FUNCTION switch to ACA.
3. Set RANGE switch to 2000 m or the desired lower range if known.
4. Connect unknown ac current across A and COMMON terminals. Reduce range switch until proper reading is reached.
5. Read ac current on the display. Decimal point is correctly positioned.

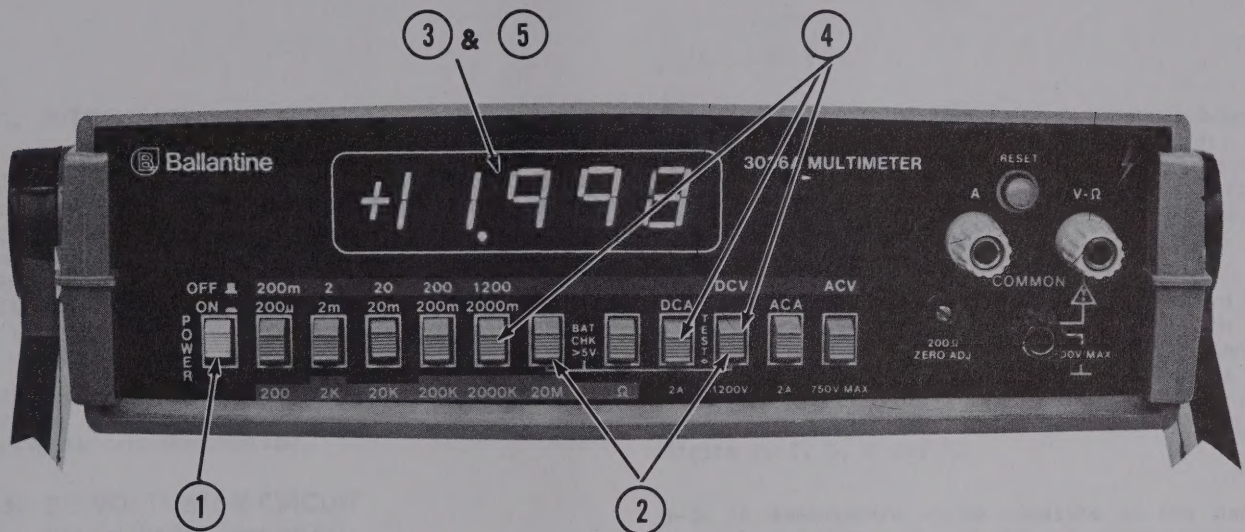
NOTE

A flashing display indicates overload. Switch to the next higher range until a steady display appears.

CAUTION

A current in excess of 2 A applied across the A and COMMON terminals will trip the circuit breaker. If the breaker trips, its reset button will extend farther from the panel. To reset, simply push the RESET button. DO NOT apply peak current exceeding 15 Amperes.

Figure 3-6. AC Current Measurements



1. Set POWER switch to ON.
2. Push DCV and 20 MΩ range to check battery charge condition.
3. Note display reading, above 5.000 is acceptable. Below 5.000 reading indicates discharged batteries. Recharge batteries as described in paragraph 2-23.
4. Push DCV and DCA simultaneously to check segments of the four LED numerics of the display. Also push 2000 k range to properly set decimal point.
5. Display reading should be +888.8 to verify that all segments of the display numerics are functioning.
6. Check other decimal points by changing range to 200 k for +88.88 and 20 k for +8.888 and 2 k for +.8888.

NOTE

When operation on batteries, do not leave instrument in display test position for an extended period since this will result in rapid discharge of the internal batteries.

Figure 3-7. Battery and Display Check

SECTION 4

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section of the manual contains a description of the circuitry used in the 3036A/B. Figure 4-1 is a detailed block diagram of the instrument. Basically, the diagram can be broken down into 5 functional areas. These are: DC voltmeter circuit, Ohms converter, current shunts, AC to DC converter circuit and power supply.

A complete schematic is given at the rear of this manual. Refer to this diagram throughout the following circuit description.

4-3. DC VOLTMETER CIRCUIT (dc to digital converter)

4-4. The DC input voltage is coupled to the analog processor U5 via a precision attenuator and a two-section low-pass filter comprising R26, C9 and R27, C8. The input voltage to the processor is limited by voltage limiters. Ranging resistors in the attenuator are selected by the front panel RANGE switches to provide a 200 mV full scale voltage to the analog processor, U5 for the 200 mV and 20 V ranges and a 2 V full scale voltage for all other range settings.

The monolithic analog processor contains a bipolar comparator, a bipolar integrating amplifier, two MOS-FET input unity gain amplifiers, several analog switches and the necessary level shifting drivers to allow the analog and digital processors to be directly interfaced.

The digital processor U6 combines the counting, storage and data multiplexing functions with the random logic necessary to control the function of the analog processor. Output buffers provide the sign, digit strobe and multiplexed BCD data outputs. The digit scan is an interlace format of digits 1, 2, 3, 4 and 5.

4-5. A measurement cycle consists of two parts: the measure interval and the auto-zero interval. In the measure interval, a conversion technique balances the charge supplied by a current proportional to the input voltage with an accumulation of quantized charges equal to a BCD count. The units of quantized charge are provided through pulsewidth modulation of a reference current.

The auto-zero interval allows the effect of offset, temperatures and drift to be impressed on the auto-zero storage voltage, which is maintained as

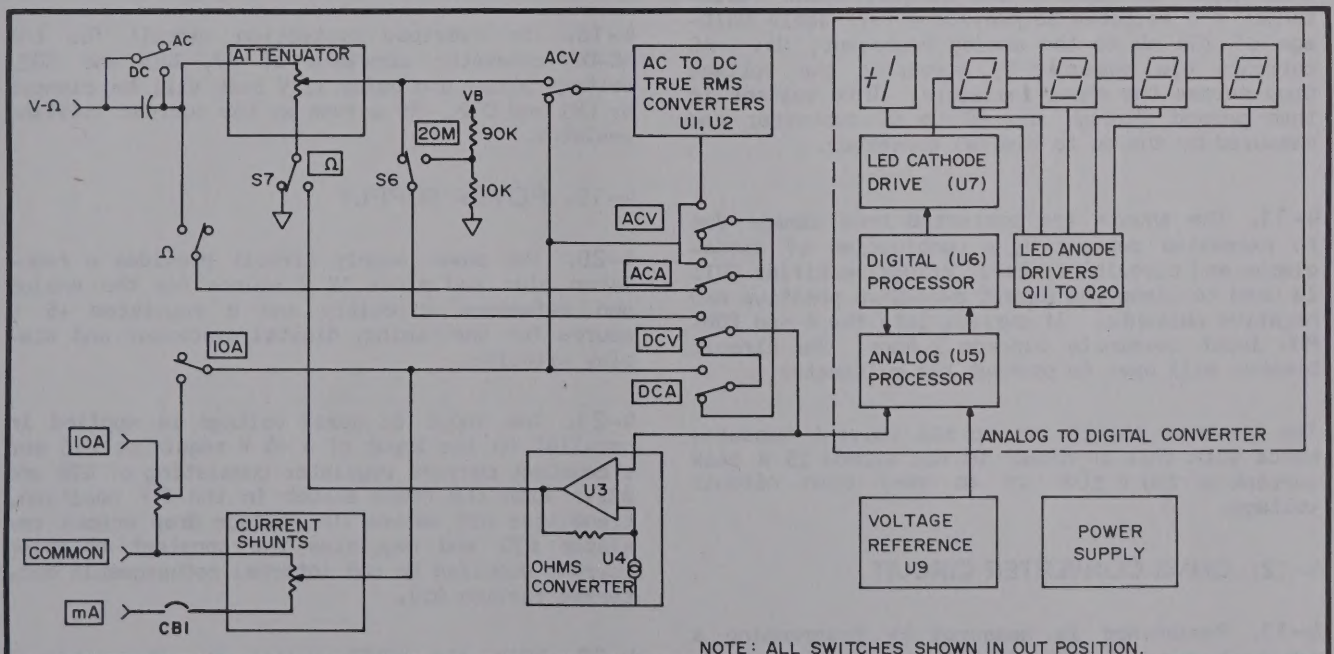


Figure 4-1. Block Diagram

a reference by capacitor C11. Therefore, during the succeeding measure interval these effects will be balanced out. The input of the buffer amplifier is grounded during the auto-zero interval. A fine adjustment of the auto-zero system is provided by R90 which permits tracking between the 200 mV and 2 V full scale operating modes of the analog to digital converter.

4-6. The digital processor has a built-in over-range flashing circuit. The presence of a count of 20000 or greater in the BCD counter causes the $4\frac{1}{2}$ digit display to blink off during the zero cycle resulting in a blink rate equal to the sampling rate.

4-7. The decoder driver U7 translates the BCD information from the digital processor to drive the cathodes of the LED readouts DS2, DS3, DS4 and DS5. The anodes are controlled by the digital processor U6 driving transistors Q11 thru Q20. The digit-strobe pulses from U6 determine which readout receives the proper anode voltage at the proper time. The most significant digit is readout DS1. Two segments are used to form a numerical "1" and two other segments form the plus or minus polarity signs. The "1" segments are driven by transistors Q7 and Q8, while the polarity signs are driven by Q5 and Q6. The decimal point illumination is controlled by U8, Q9 and Q10 with RANGE switches S2B, S3B, S5B and S6A.

4-8. Timing signals for the analog and digital processors are generated by oscillator Q21, L1, C13, C14, R46 and R47.

4-9. DC AND AC CURRENT CIRCUIT

4-10. Direct current is measured by monitoring the voltage drop caused by the unknown current flowing through the precision shunt resistors R13 thru R18. In each of the ranges, shunt resistances are selected to provide a full scale voltage of 200 mV to the analog processor, U5. AC currents are measured by measuring the voltage drop across the shunt resistors. This voltage is then passed through the AC to DC converter and measured by the dc to digital converter.

4-11. The shunts are protected from damage due to excessive current by a combination of diode-clamps and circuit breaker. Bridge rectifier CR11 is used to clamp and divert excessive positive and negative currents. If current into the A and COMMON input terminals exceeds 2 Amps, the circuit breaker will open to protect the multimeter.

The operator should set up all current measurements with this in mind. Do not exceed 15 A peak current or 250 V $\pm$ (dc or ac rms) open circuit voltage.

4-12. OHMS CONVERTER CIRCUIT

4-13. Resistance is measured by programming a constant current through the unknown resistance and measuring system. A feedback circuit consisting of bootstrap amplifier U3, a constant current

regulator consisting of Q2 and Q3 and ranging resistors, act as a constant current generator to supply a test current of 1 mA for the 199.99 ohms and 1.9999 kilohms ranges, 10 μ A for the 19.999 kilohm range, 10 μ A for the 199.99 kilohm range, 1 μ A for the 1999.9 kilohm range and 100 nA for the 19.999 megohm range. The bootstrap amplifier output is equal to the voltage at the analog processor input U5 (pin 15) plus 1 V generated by the voltage drop across R22 caused by the precision 1 mA constant current source.

4-14. The constant current generator is comprised of U4, Q1 and Q29. Zener diode CR4 provides a reference voltage of 6.2 V. This voltage causes a constant voltage drop across R23 and R24 resulting in a constant current of 1 mA to flow in the collector circuit of Q1. U3 is a FET-input-high-performance operational amplifier and the current drawn by its input is negligible.

4-15. The overload protection circuit for the ohms converter consists of CR3, CR5, Q1, Q29 and Q3. Positive voltage will reverse bias CR5, Q29 and Q1 which will act like an open switch. Negative voltage will reverse bias CR3 and Q3 which will act like an open switch disconnect.

4-16. AC-DC TRUE RMS CONVERTER CIRCUIT

4-17. The AC-DC converter consists of U1 and wideband true rms converter U2. Series capacitors C1 and C3 blocks DC voltages so that only AC voltages are measured. U1 is being used as an impedance converter and as a source follower with unity gain for ranges 2 V, 200 V and 1200 V. For 200 mV and 20 V ranges, U1 is used as an amplifier with gain of 10. Gain of 10 is obtained when switches S1B and S3A are closed. In each of the ranges the gain of U1 is changed to provide a 2 V full scale input to the analog processor, U5.

4-18. The overload protection circuit for the AC-DC converter consists of R9, CR1 and CR2. Voltage above and below 12 V peak will be clamped by CR1 and CR2. R9 serves as the current limiting resistor.

4-19. POWER SUPPLY

4-20. The power supply circuit provides a regulated plus and minus 12 V source for the analog and reference circuitry and a regulated +5 V source for the timing, digital processor and display circuits.

4-21. The input dc power voltage is applied in parallel to the input of a +5 V regulator U20 and a constant current regulator consisting of Q28 and Q22. With the POWER switch in the OFF position, transistor Q28 senses the voltage drop across resistor R70 and regulates the constant charging current supplied to the internal rechargeable batteries (option 05).

4-22. With the POWER switch ON, the optional batteries are trickle-charged with charging current limited by resistor R73. Voltage regulator

U20 supplies a constant +5 V to operate the instrument.

WARNING

Use only nickel-cadmium cells to power the instrument. Use of alkaline or carbon zinc cells may cause damage and void the warranty.

4-23. The optional rechargeable battery supply powers the DMM whenever line voltage is removed or drops below the minimum needed to drive regulator U20. Four NiCad cells are the battery power source.

4-24. The four batteries are wired in series to provide nominally 4.8 V. Q23 acts as the battery cutout switch to guard against battery reversal and to automatically switch the batteries out of the circuit when power is supplied through U20.

4-25. To charge the batteries the POWER pushbutton is set OFF and the ac or dc input power is applied. The batteries are charged by the constant current source described above. The instrument is not operating when batteries are being charged.

4-26. The dc to dc converter consists of a solid state switch Q24 and differential amplifier Q26 and Q27. The pulses generated are rectified by diodes CR22 and CR24. Capacitors C24 and C25 filter the rectified voltage of +12 and -12 V dc.

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

CAUTION

Semi-conductor devices using metal oxide junctions are liable to suffer destructive damage from electrostatic discharges. Such devices appear with several names, such as MOS, MCMOS, CMOS, MOSFET, IGET, detector diode, etc. Whenever these devices or assemblies including such devices are handled, the operator must be grounded, and only grounded soldering irons can be used safely. To facilitate identification of assemblies containing metal oxide devices, Ballantine pc boards containing such devices are marked with this symbol:



SECTION 5

MAINTENANCE AND CALIBRATION

5-1. INTRODUCTION

5-2. This section contains information required to maintain the instrument within specifications. The following paragraphs detail:

- a. Performance Verification Checks
- b. Calibration Procedures
- c. Fault Finding (Troubleshooting) details
- d. Preventive Maintenance

5-3. The instrument is designed with premium components. Like other Ballantine instruments, it will provide many years of satisfactory service. Ballantine recommends that performance verification checks and preventive maintenance procedures be performed on the following schedule:

- a. Routine laboratory service every 12 months or 1,000 hours of use; whichever comes first.

b. Service in the field or in extended environments every six months or 450 hours of use; whichever comes first.

5-4. Full NBS traceable calibration should be performed once each year. Normally the user will provide recalibration services in his plant. If required, Ballantine will gladly provide this calibration service at our Boonton, NJ service center for a nominal charge.

5-5. REQUIRED TEST EQUIPMENT

5-6. Table 5-1 provides a list of test equipment required to properly check, calibrate, and maintain the instrument. Equivalent test equipment meeting all the minimum requirements may be substituted if the recommended items are not available.

TABLE 5-1. REQUIRED TEST EQUIPMENT

INSTRUMENT	PURPOSE	RECOMMENDED MODEL	SPECIFICATIONS
DC Voltage Calibrator	DC Voltage Calibration	Fluke 332B	1.0 mV to 1100 V dc. Five-digit resolution. 0.003% accuracy.
AC Voltage Calibrator	AC Voltage Calibration	H-P745A/746A or Fluke 5200A/5215	1.0 mV to 1100 V ac. 10 Hz to 110 kHz. Five-digit resolution. 0.05% accuracy.
AC/DC Transconductance Amplifier	DC and AC Current Calibration	Ballantine 1620A	100 uA to 2 A, 0.02% accuracy. 0.25% AC accuracy to 10 kHz.
Resistance Standard	Ohmmeter Calibration	Shallcross 883 or equivalent	10 Ω to 10 M Ω . $\pm 0.05\%$ accuracy. Decade dials.
AC/DC True RMS Voltmeter	Line Voltage Measurement	Ballantine 3620A	10 mV to 1 kV, dc and ac true rms. 0.25% accuracy. $4\frac{1}{2}$ -digit resolution. 1 uV resolution.
Digital Multimeter	Troubleshooting Tool	Ballantine 3028B	DC volts to 1.2 kV. AC volts to 1.2 kV. 20 Hz to 50 kHz, 10 Ω , 100 to 2 M Ω . HI Ω , 1 k Ω to 20 M Ω . AC current to 2A. DC current to 2A. $3\frac{1}{2}$ digits.
Oscilloscope with probes	Troubleshooting Tool	Ballantine 1022A with 10601C probes	Dual Trace. 5 mV, dc to 15 MHz. 100 ns/cm to 1 sec/cm. 10:1 divider probes.
Line Control Variac	Set Line Voltage	General Radio W5MT3AW	0 V to 135 V (0 V to 270 V).
Frequency Counter	Check A to D Converter Clock Frequency	Ballantine 5720A or 5500B	8 digits, 10 Hz to 1 MHz.

5-7. PERFORMANCE VERIFICATION CHECKS

5-8. The performance verification checks are "in cabinet" checks that compare the instrument with the applicable performance specifications. The sample performance test record, Form 5-1, may be used or duplicated to provide permanent performance test records. Beginning with incoming inspection checks, periodic performance verification checks should be made in the sequence detailed below and before any attempt is made to calibrate the instrument. The performance verification checks should also be used as part of the troubleshooting procedure and before returning the instrument to regular service after repair, recalibration, or extended storage. All checks are made at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and with COMMON connected to case ground. Use ac mains or internal battery power and ground the case to earth ground.

NOTE

Prior to making any of the following performance verification checks set ac line voltage to 120 volts. If battery power is used, charge batteries at least 8 hours. Exercise each of the pushbuttons several times to clean switch contacts by self-wiping action.

5-9. POWER SUPPLY AND DISPLAY CHECK

5-10. To check the power supply regulation and the display proceed as follows:

a. Connect the instrument with ac power adapter to the ac mains through a Variac voltage control unit. Monitor ac voltage with the true rms responding ac voltmeter. DC power input from an external power supply is also acceptable (9.4 V nominal).

b. Set DMM pushbuttons as follows:

Function	DCA
Range	200 u

c. Set ac mains voltage to 120 ± 2 V.

d. Depress POWER pushbutton switch to "ON".

e. Observe that the digital display reads 00.00 to 00.02.

f. Depress DCV and DCA pushbuttons simultaneously and depress 2000 k.

g. Observe that the digital display reads +888.8 as an indication that the display performs satisfactorily.

h. Release DCV pushbutton but depress DCA pushbutton to retain current function.

i. Lower mains voltage to 102 V (or 8.5 V dc) and observe that the DMM display does not change. This checks low line voltage operation.

j. Raise mains voltage to 130 volts (or +12 V dc) and observe that the DMM display does not change. This checks high line voltage operation. Reset ac mains voltage to 120 volts.

5-11. BATTERY CHECK - OPTION 05

NOTE

This battery check is required only when a rechargeable battery is installed.

a. Continue as in step 5-10(j) but disconnect ac mains power cable. Connect earth ground to rear panel ground lug or the case ground binding post on the 3036B-968.

b. Observe that the batteries power the unit and that the display does not change.

c. Depress the DCV and 20 M Ω pushbuttons simultaneously.

d. Observe that the display reads greater than 5.000 to indicate that the batteries are charged. Fully charged batteries will check at above 5.250.

5-12. DC VOLTAGE ACCURACY CHECK

5-13. To check the dc voltage accuracy of the instrument proceed as follows:

a. Set function pushbutton switch to DCV.

b. Set POWER pushbutton switch to "ON".

c. Depress range pushbutton switch for "200 m".

d. Connect a short across the V- Ω and COMMON input connectors.

e. Note a display reading of 00.00 ± 2 counts.

f. Depress "2".

g. Note a display reading of 0.000 ± 2 counts.

h. Remove the short from V- Ω and COMMON.

i. Connect the DC voltage calibrator positive output to the V- Ω input connector of the DMM and connect the calibrator negative output to the COMMON connector.

j. Proceed to check dc voltage accuracy at each setting of the voltage calibrator listed in Table 5-2. In each case, the digital readout display of the DMM should be within the tolerance shown.

k. For negative readings reverse input leads at the DC voltage calibrator.

TABLE 5-2. DC VOLTAGE ACCURACY CHECK

DC Voltage Standard	Range Switch Setting	3036A Readout Limits		3036B/B-968 Readout Limits	
		Minimum	Maximum	Minimum	Maximum
0.0000 (Short)	200 mV	+ 00.00	+ 00.02	+ 00.00	+ 00.02
+0.1000		+ 99.94	+100.06	+ 99.94	+100.06
+0.1900		+189.89	+190.11	+189.92	+190.08
0.0000	2 V	+ .0000	+ .0002	+ .0000	+ .0002
+1.0000		+ .9994	+1.0006	+ .9994	+1.0006
+1.9000		+1.8989	+1.9011	+1.8992	+1.9008
-1.9000	20 V	-1.8989	-1.9011	-1.8992	-1.9008
+10.000		+ 9.994	+10.006	+ 9.994	+10.006
+19.000		+18.989	+19.011	+18.992	+19.008
+100.00	200 V	+ 99.94	+100.06	+ 99.94	+100.06
+190.00		+189.89	+190.11	+189.92	+190.08
+ 500.0	1200 V	+ 499.6	+ 500.4	+ 499.5	+ 500.5
+1000.0		+ 999.4	+1000.6	+ 999.4	+1000.6

5-14. DC CURRENT ACCURACY CHECK

5-15. Set the DMM controls as follows:

- a. Power ON
- b. Function DCA
- c. Range 200 m

5-16. Connect the A input connector of the DMM to the positive output of the AC/DC Transduc-

tance Amplifier and the COMMON input connector to the negative output terminal of the Transconductance Amplifier. Connect the dc voltage calibrator to drive the Transconductance Amplifier. Set the Transconductance Amplifier range as required to achieve the test currents of Table 5-3. 2 volts input produce full range current output from the Transconductance Amplifier.

5-17. Check the accuracy of the DMM at each setting of the dc current calibrator listed in Table 5-3. In each case the displayed readout must be within the tolerances shown.

TABLE 5-3. DC CURRENT ACCURACY CHECK

DC Current Input (milliamps)	Range Switch Setting	3036A Readout Limits		3036B/B-968 Readout Limits	
		Minimum	Maximum	Minimum	Maximum
0.0000 (Short)	200 μ A	+ 00.00	+ 00.03	+ 00.00	+ 00.03
+0.1000		+ 99.77	+100.23	+ 99.87	+100.13
+0.1900		+189.59	+190.41	+189.78	+190.22
-0.1900		-189.59	-190.41	-189.78	-190.22
+1.0000	2 mA	+ .9977	+1.0023	+ .9987	+1.0013
+1.9000		+1.8959	+1.9041	+1.8978	+1.9022
+19.000	20 mA	+18.959	+19.041	+18.978	+19.022
+190.00	200 mA	+189.59	+190.41	+189.78	+190.22
+1900.0	2000 mA	+1895.9	+1904.1	+1897.8	+1902.2

5-18. AC VOLTAGE ACCURACY CHECKS

5-19. Set the DMM controls as follows:

- a. Power ON
- b. Function ACV
- c. Range 1200

5-20. Connect the ac voltage calibrator to the V- Ω and COMMON input connectors of the DMM.

5-21. Check the accuracy at each setting of voltage and frequency of the ac voltage calibrator as listed in Table 5-4. In each case the displayed readout must be within the tolerances shown.

TABLE 5-4. AC VOLTAGE ACCURACY
(COMMON tied to earth ground)

AC Voltage Calibrator		Range	DMM			
			3036A		3036B/B-968	
			Low Limit	High Limit	Low Limit	High Limit
0000 (Short)	500 Hz	200 m	00.00	00.05	00.00	00.05
100.00 mV	500 Hz	200 m	99.35	100.65	99.50	100.50
190 mV	500 Hz	200 m	188.81	191.19	189.32	190.68
190 mV	20 kHz	200 m	188.81	191.19	188.75	191.25
1.900 V	30 Hz	2	1.8805	1.9195	1.8780	1.9220
1.900 V	500 Hz	2	1.8881	1.9119	1.8932	1.9068
1.900 V	20 kHz	2	1.8881	1.9119	1.8875	1.9125
19.00 V	500 Hz	20	18.881	19.119	18.932	19.068
19.00 V	20 kHz	20	18.881	19.119	18.875	19.125
190.0 V	500 Hz	200	18.881	191.19	189.32	190.68
190.0 V	20 kHz	200	188.81	191.19	188.75	191.25
750.0 V	500 Hz	1200	745.0	755.0	747.0	753.0
750.0 V	10 kHz	1200	742.0	758.0	747.0	753.0
750.0 V	20 kHz	1200	N/A	N/A	744.7	755.3

5-22. AC CURRENT ACCURACY CHECKS

5-23. AC current checks are optional. The current shunts within the instrument are used for both ac and dc. They are noninductive and have only a small effect on AC current response which is determined by the ac to dc converter fully tested in paragraph 5-18 for ac voltage accuracy. Current accuracy is, therefore, checked for both ac and dc in paragraph 5-14. The following procedure is, therefore, given for reference only and need not be regularly performed. AC current accuracy checks are not required for the Performance Test Record Form 5-1.

5-24. Set DMM controls as follows:

- a. Power ON
- b. Function ACA
- c. Range 2000 m

5-25. Connect the AC/DC Transconductance Amplifier to the A and COMMON input connectors of the DMM. Connect the ac voltage calibrator to drive the input of the Transconductance Amplifier.

5-26. Check the accuracy at each setting of current and frequency of the DMM listed in Table 5-5.

TABLE 5-5. OPTIONAL AC CURRENT ACCURACY CHECK
(COMMON tied to earth ground)

AC Current Input		DMM Range	3036A		3036B/B-968	
			Readout Limits		Readout Limits	
Current	Frequency		Minimum	Maximum	Minimum	Maximum
0000 (Short)	-	200 μ	00.00	00.05	00.00	00.05
100.00 μ A	500 Hz	200 μ	99.25	100.75	99.45	100.55
190.00 μ A	10 kHz	200 μ	188.62	191.38	189.00	191.00
1.9000 mA	30 Hz	2 m	1.8805	1.9195	1.8805	1.9195
1.9000 mA	500 Hz	2 m	1.8862	1.9138	1.8900	1.9100
1.9000 mA	10 kHz	2 m	1.8862	1.9138	1.8900	1.9100
19.000 mA	500 Hz	20 m	18.862	19.138	18.900	19.100
19.000 mA	10 kHz	20 m	18.862	19.138	18.900	19.100
190.00 mA	500 Hz	200 m	188.62	191.38	189.00	191.00
190.00 mA	10 kHz	200 m	188.62	191.38	189.00	191.00
1.9 A	500 Hz	2000 m	1886.2	1913.8	1890.0	1910.0
1.9 A	1 kHz	2000 m	1886.2	1913.8	1890.0	1910.0

5-27. OHMS RANGES ACCURACY CHECKS

5-28. Set DMM controls as follows:

- Power ON
- Function Ω
- Range 200 Ω
- 200 Ω Zero Connect test leads to V- Ω and COMMON. Short test leads together and adjust ZERO for a display of 00.00.

5-29. Connect the Resistance Standard to the V- Ω and COMMON input connectors of the DMM using the same test leads of step 5-28(d) above.

5-30. Check the resistance accuracy of the DMM at each setting of the resistance standard listed in Table 5-6. In each case, the displayed readout must be within the tolerances shown.

TABLE 5-6. RESISTANCE ACCURACY CHECKS

Standard Resistance	DMM Range Switch Setting	3036A		3036B/B-968	
		Readout Limits		Readout Limits	
		Minimum	Maximum	Minimum	Maximum
00.00 (Short)	200 Ω	00.00	00.02(Set)	00.00	00.02(Set)
1.9 K Ω	2 K Ω	1.8978	1.9022	1.8990	1.9010
19 K Ω	20 K Ω	18.978	19.022	18.990	19.010
190 K Ω	200 K Ω	189.78	190.22	189.90	190.10
1.9 K Ω	2000 K Ω	1897.8	1902.2	1898.1	1901.9
19 M Ω	20 M Ω	18.959	19.041	18.981	19.019

5-31. CALIBRATION PROCEDURES

5-32. If any of the Performance Verification checks show an out-of-tolerance condition, recalibration will be required. Table 5-1 lists the test equipment required to completely calibrate and certify the instrument. If the instrument cannot be adjusted, refer to the troubleshooting and fault finding procedures beginning with paragraph 5-61.

NOTE

Only a qualified service technician with properly calibrated test equipment should service this instrument; since internal voltages may cause shock hazard. Calibrate at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and connect COMMON to earth ground.

CAUTION

Always remove ac mains power before removing covers to avoid personnel shock hazard.

5-33. REMOVAL OF COVERS, MODEL 3036A/B

5-34. To remove the top and bottom covers, first disconnect the ac mains and single cables. The top and bottom covers of the plastic enclosure are fastened together by four screws which are accessible through the bumper feet at the bottom cover. To remove the covers, first disconnect ac power cord. Then remove the four screws and carefully pull the top cover up and out evenly from the side sections. Take care not to misplace the four spacer sleeves used to space the top cover on the side supports. These spacers support the unit and provide electrical connections for the metallic coating shield on the top cover and side supports. Always remove NiCad batteries at this point if Option 05 is installed. The side sections may then be removed by pulling up from the bottom cover. The front and rear panels will now be free of support. The printed wiring board may be separated from the bottom cover by removing the retaining screws accessible at the top of the printed wiring board.

NOTE

When making final calibration always have the bottom cover, panels, and side supports installed with proper electrical interconnection to the metallic coating since it serves as a guard shield to minimize unwanted noise pick-up.

5-35. REMOVAL FROM COMBINATION CASE, MODEL 3036B-968

5-36. To remove the combination case from the 3036B-968, first disconnect the AC mains cable. Then, unlatch the protective cover of the combination case and remove it from the body of the case by pushing sideways against the slip hinges. Once the protective cover is separated, unscrew the four 6-32 screws holding the feet to the case. These four screws also retain the internal structure of the instrument. After the four screws holding the feet are removed, stand the combination case on its rear so that the panel faces up. Unscrew the six retaining panel screws at the periphery of the top and bottom edges of the front panel. Once the panel retaining screws are removed, free the panel which now supports the internal structure of the instrument by carefully lifting the panel by its handles. Lift up and pull out of the case so as to separate the instrument from the case. Be careful not to short the NiCad batteries to the case. The instrument is now fully exposed for maintenance and calibration. Reverse the above procedure to re-install the instrument into the combination case and make certain all gaskets are firmly in place to assure environmental performance.

5-37. PRELIMINARY INSPECTION

5-38. Always check the voltmeter for mechanical damage, loose parts, faulty solder joints, burned resistors, etc. Use a low wattage (25 watts) grounded soldering iron to make repairs and always replace components with exact equivalents to be certain that all performance specifications can be obtained. Use heat shunts when soldering diodes and semiconductors. Do not overheat circuit board printed wiring and pads.

5-39. INTERNAL ADJUSTMENTS AND TEST POINTS

5-40. See Figure 5-1 for the location of internal adjustments and test points.

5-41. INITIAL POWER SUPPLY CHECKS

5-42. The DMM has no power supply adjustments but power input voltage regulation should be checked before calibration. Monitor the three dc power supply voltages of the DMM and observe voltages listed in Table 5-7 with a dc voltmeter.

TABLE 5-7. DC POWER SUPPLY LIMITS

SUPPLY	VOLTAGE LIMITS
+ 5	+ 4.30 to +5.60
+12	+10.5 to +14
-12	-10.5 to -14

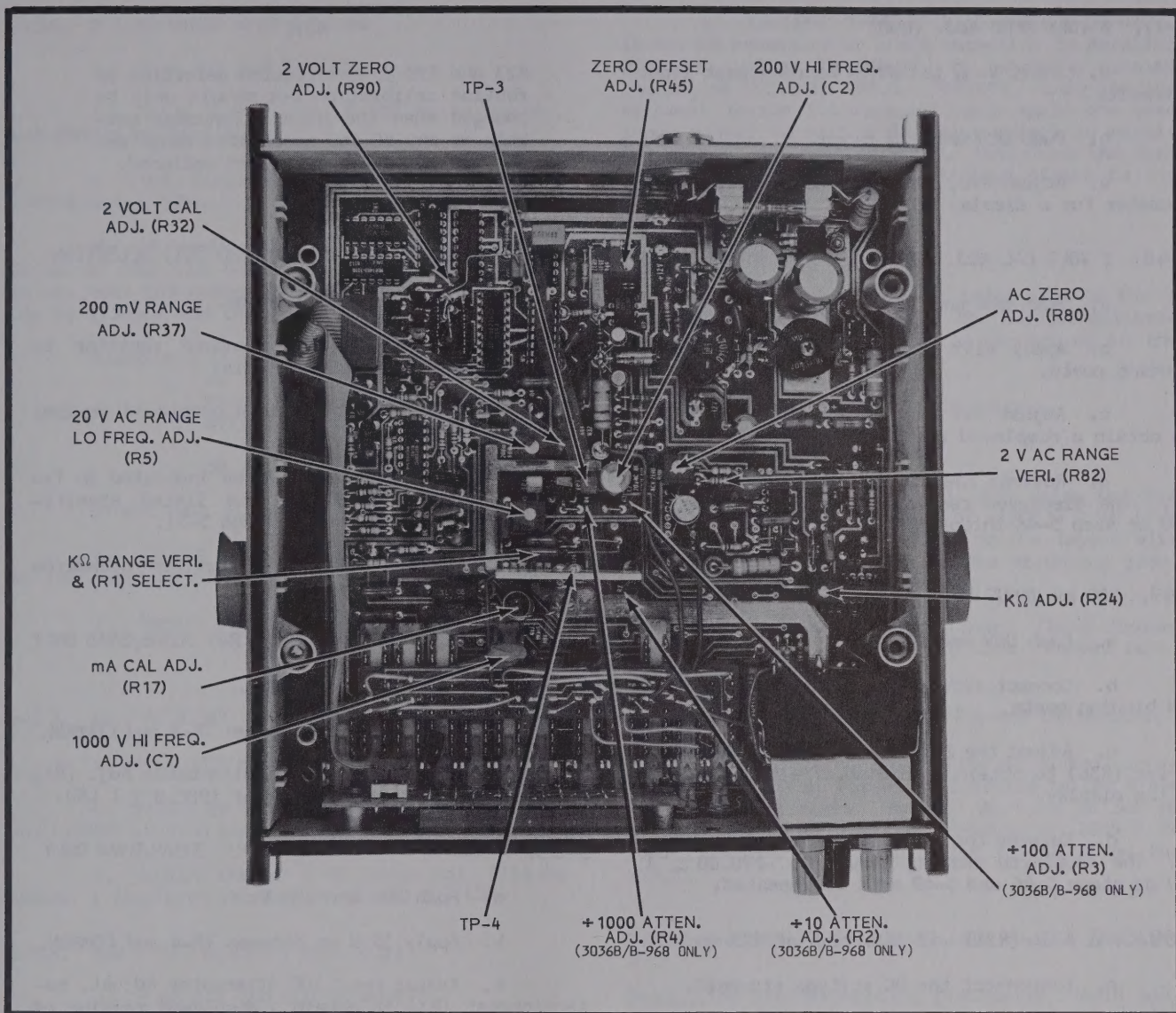


Figure 5-1. Location of Internal Adjustments and Test Points

5-43. CALIBRATION

5-44. All calibration is performed at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ with ac power turned ON and ac mains voltage set to 120 volts (or 100 V, 220 V, 240 V ac or 9.4 V dc). Connect COMMON to instrument case and earth ground using the rear panel grounding lug on the 3036A/B and the case ground binding post on the 3036B-968.

CAUTION

Always perform the calibration in the sequence indicated below.

5-45. INITIAL CHECK AND WARM UP

- Push DCV and 2000 k simultaneously for display test reading of +888.8.
- Allow 20 minutes for warm up. Cover open unit to allow for normal heat rise.

5-46. ZERO OFFSET ADJ. (R45)

- Push DCA and 2000 mA range.
- Disconnect all input leads from input A binding post.
- Adjust R45, the ZERO OFFSET ADJ., for a display reading of 000.0 which sets the 200 mV sensitivity ZERO offset of the analog processor.

5-47. 2 VOLT ZERO ADJ. (R90)

- a. Short V- Ω to COMMON binding post input connector.
- b. Push DCV and 2 V range.
- c. Adjust R90, the 2 VOLT ZERO ADJ., potentiometer for a display of .0000.

5-48. 2 VOLT CAL ADJ. (R32)

- a. Push DCV and 2 V range.
- b. Apply +1.9 V dc to the V- Ω and COMMON binding posts.
- c. Adjust the 2 V CAL potentiometer (R32) to obtain a displayed reading of $+1.9000 \pm 1$ LSD.
- d. Reverse the input leads to apply -1.9 V dc. The displayed reading should be -1.9000 ± 1 LSD or step 5-46 through 5-48 must be repeated.

5-49. 200 mV RANGE ADJ. (R37)

- a. Push DCV and 200 m.
- b. Connect +190 mV dc to the V- Ω and COMMON binding posts.
- c. Adjust the 200 mV range adjust potentiometer (R36) to obtain a reading of $+190.00 \pm 1$ LSD on the display.
- d. Reverse the input leads to apply -190 mV dc. The displayed reading should be -190.00 ± 1 LSD or steps 5-46 and 5-49 must be repeated.

5-50. K Ω ADJ. (R24) and selection of R23 and R98

- a. Disconnect the DC voltage standard.
- b. Push K Ω and 200 K range.
- c. Set R24 to mid-range.
- d. Connect a 190 K Ω standard resistor between the V- Ω and COMMON binding posts.
- e. Note that the displayed reading falls within the range of 189.50 and 190.50. If not in this nominal range, select R23 until a reading of 189.78 to 190.22 is obtained for 3036A or 189.90 to 190.10 is obtained for 3036B.
- f. Adjust K Ω Adj. potentiometer (R24) for a displayed reading of 190.00 ± 2 LSD.

g. Remove the 190 K Ω standard resistor and connect a 19 megohm standard resistor to the V- Ω and COMMON input binding post. Set the instrument to the 20 M range. The display should read within the 20 M limits given in Table 5-6. To bring the instrument into calibration select R98. The display will be decreased by one LSD for every 1000 ohm increase in R98. The display will increase by one LSD for every 1000 ohm decrease in R98. Be sure that all surface contamination is removed from the circuitry of the 3036A/B before changing R98.

NOTE

R23 and R98 do not require selection in routine calibration but should only be changed when the input attenuator network or any of its associated range adjustment potentiometers are replaced.

5-51. K Ω RANGE VERIFICATION AND (R1) SELECTION

- a. Push Ω and 2 K range.
- b. Connect 1.9 K Ω standard resistor to the V- Ω and COMMON binding posts.
- c. Select R1 to obtain a displayed reading of 1.9000 ± 1 LSD.
- d. Check all Ω ranges as indicated in Table 5-6 and if not within the listed specifications repeat steps 5-48 through 5-51.
- e. Disconnect ohms calibration standards from V- Ω and COMMON.

5-52. $\div$ 1000 ATTENUATOR ADJ. (R4) 3036B/B968 ONLY

- a. Push DCV and 1200 V.
- b. Apply 19 V dc between TP-3 and COMMON.
- c. Adjust the $\div$ 1000 Attenuator Adj. (R4) to obtain a displayed reading of 1900.0 ± 1 LSD.

5-53. $\div$ 100 ATTENUATOR ADJ. (R3) 3036B/B968 ONLY

- a. Push DCV and 200 V.
- b. Apply 19 V dc between TP-4 and COMMON.
- c. Adjust the $\div$ 100 Attenuator Adjust. potentiometer (R3) to obtain a displayed reading of 190.00 ± 1 LSD.

5-54. $\div$ 10 ATTENUATOR ADJ. (R2) 3036B/B968 ONLY

- a. Push DCV and 1200 V.
- b. Apply 1000 V dc to the V- Ω and COMMON binding posts.
- c. Adjust the $\div$ 10 Attenuator Adjust. potentiometer R2 to obtain displayed reading of 1000.0 ± 1 LSD.
- d. Disconnect the DC Voltage Calibrator.

5-55. AC ZERO ADJ. (R80)

- a. Push ACV and 2 V range.
- b. Place short between V- Ω and COMMON.
- c. Adjust AC Zero Adj. potentiometer R80 to obtain a displayed reading of $0.0000 + 1$ LSD.
- d. Push 200 mV range and note ZERO shift. Adjust for half the reading observed. (CAUTION: Do not adjust thru ZERO.)

5-56. 2 V AC RANGE VERIFICATION

- a. Push ACV and 2 V range.
- b. Apply 1.9 V rms at 500 Hz to the V- Ω and COMMON binding posts.
- c. The display reading must be between 1.8994 and 1.9006.
- d. If reading is <1.8994, then change the value of R82 (10 Ohms). To select the proper value, note the number of digits off. Then multiply by 1.3 and add the value of R82.

Example: If the meter indicates a reading of 1.8962 and R82 is 10 ohms then the difference is 38 counts offset.

$$38 \times 1.3 = 49.4 + 10 = 59.4 \Omega$$

Select next closest value 56.1 Ω or 61.9 Ω

- e. If R82 is >25 ohms, therefore, R81 must be increased to 100 k.
- f. Repeat paragraph 5-55 and 5-56.

5-57. 20 V AC RANGE LO FREQUENCY ADJ. (R5)

- a. Push ACV and 20 V range.
- b. Apply 19 V rms at 500 Hz to the V- Ω and COMMON binding post.
- c. Adjust the 20 V AC Range Adj. (R5) to obtain a displayed reading of 19.000 ± 2 LSD.

5-58. 200 V HI FREQUENCY ADJ. (C2)

- a. Push ACV and 200 V range.
- b. Apply 190 V rms at 10 kHz (3036A) 20 kHz (3036B) to V- Ω and COMMON.
- c. Use an insulated alignment tool to adjust 200 V. Hi Frequency Adj. trimmer (C2) to obtain a reading of 190.00 ± 5 LSD.

NOTE

Enclosing the instrument with a grounded top cover will add capacity and slightly change the calibration setting of C2. Determine the displayed difference in reading with the cover properly installed and add this difference in reading to the adjustment of C2 in step c above.

5-59. 1000 V HI FREQUENCY ADJ. (C7)

- a. Push ACV and 1200 V range.
- b. Apply 750 V at 10 kHz for 3036A/B and 1000 V at 20 kHz for 3036B-968.

c. Caution "DANGER" high voltage present. It may be necessary to add a capacitor in parallel with C7 (100 pF to 800 pF) to obtain a display reading of 995.0 to 999.0. "NOTE": Place the instrument inside its case and again apply the same input signal to verify the value select in parallel with C7 has been effected. Determine the difference of the effect and add this offset to the previous reading.

5-60. mA CAL ADJ. (R17)

- a. Connect DC current calibrator to the A and COMMON binding post. Set the current calibrator for minimum output prior to connecting to the DMM.
- b. Push DCA and 2000 m range.
- c. Apply +1.90 A dc.
- d. Adjust the mA Cal. Adj. wire tap R17 to obtain a display reading of $+1900.0 \pm 10$ LSD. Adjustment is made by unsoldering the tapped wire and sliding it (while holding the soldering iron) until the reading is observed.
- e. Allow R17 to cool down. Check display reading again for 1900.0 ± 10 LSD. Repeat paragraphs d and e if necessary.
- f. Disconnect the DC Current Calibrator.

g. An optional check for AC current accuracy connect on AC Current Calibrator to the A and COMMON binding posts. Apply 1.90 A rms at 500 Hz and check for a displayed reading of 1895.9 to 1904.1 on the 3036A and 1897.8 to 1902.2 on the 3036B.

5-61. TROUBLESHOOTING AND FAULT FINDING

5-62. The troubleshooting procedures should only be performed when the instrument cannot be calibrated with the calibration procedures listed in paragraphs 5-43 thru 5-60. Should the instrument be inoperative or out of specification, follow the fault finding procedures listed below.

5-63. Carefully examine the instrument and check for any visual evidence of trouble. Check for broken wires, burned resistors, loose components, shorts, or open or defective solder joints on the printed circuit board. Check for separation of printed circuit board lands and pads. Check for open, defective, or intermittent switches. Check that connectors are clean and will mate properly. Check that instrument circuit ground is properly connected to the metal coating shield on the plastic case top, bottom and side supports. Check that the power line earth ground is connected only to the front and rear panels. Troubleshoot with COMMON connected to power line earth ground.

5-64. Understand and be familiar with the circuit theory of Section 4. Use the functional block diagram of Figure 4-1 and the schematic diagram to isolate the probable circuit areas which may cause the problem. Always check the power

supply voltages. Check for oscillations in the circuitry by using an oscilloscope. Then refer to the fault finding and troubleshooting hints for that circuit. Figure 5-2 gives some probable corrections for specific symptoms.

NOTE

All tests and calibration procedures listed herein consider the normal service conditions of 15°C to +35°C. Calibrate the instrument with the ambient temperature at 22°C to 25°C. Always cover top of open instrument to simulate inside case temperature conditions when making adjustments.

5-65. FUSE REPLACEMENT

5-66. The dc power line fuse F50 is located on the inside of the rear panel for the 3036A/B. To replace the fuse, remove the covers as described in paragraph 5-33, remove the defective fuse, and snap in the replacement fuse. On the 3036B-968, the ac power line fuse is located on the front panel. To remove the defective fuse rotate a quarter turn counterclockwise. The spare fuse is located inside the protective front cover.

5-67. PREVENTIVE MAINTENANCE

5-68. CLEANING. The instrument should be cleaned as often as operating conditions require. Thoroughly clean both the inside and outside of the instrument. Remove dust from inaccessible areas with low pressure compressed air or vacuum cleaner. Use alcohol applied with a cleaning brush to remove accumulations of dirt or grease from connector contacts and component terminals. Clean the exterior of the instrument and the front panel with a mild detergent mixed with water, applying the solution with a soft, lint-free cloth.

5-69. REPAIR AND REPLACEMENT. Repair and replacement of electrical and mechanical parts must be accomplished with care and caution. Printed circuit component boards can become warped, cracked or burnt from excessive heat or mechanical

stress. The following repair techniques are suggested to avoid inadvertent destruction or degradation of parts and assemblies.

a. Use a low-heat capacity soldering iron (Weller Model No. W-TCP 35 watt) with a 700°F tip 1.5 mm (1/16") to 2.5 mm (3/32") wide.

b. Be sure that the soldering iron tip and the cabinet and COMMON connectors are securely tied to "earth" ground. This avoids possible overvoltage damage to semiconductors and capacitors.

c. To desolder components, use a commercial "solder sipper", (SOLDA PULLIT manufactured by Edsyn Products or equivalent) or use solder-removing SODER-WICK, size 3, manufactured by SOLDER REMOVAL CO., Covina, California.

d. To remove a component, clip a heat sink such as long nose pliers, tweezers, or alligator clips onto the component lead and as close to the body of the component as possible. This assures minimum heating of the component while soldering.

Place the soldering iron directly on the component lead on the printed circuit conductor side of the board. Use a desoldering aid to remove all solder and free the component lead.

5-70. PUSHBUTTON SWITCHES

a. Always operate all switches several times to wipe contacts. This is especially important after long periods of storage and when the instrument has been exposed to corrosive atmospheres or high humidity.

b. Do not clean switch with trichloroethylene, freon or other solvents. Periodically lubricate all switch contacts with a light application of spray lubricant.*

*Use switch contact lubricant and cleaner such as Electrolube Contact Treatment Oil 2AX or Centralab Switch Contact Spray Lubricant, Ballantine P/N 80100090A.

POWER SUPPLY TROUBLESHOOTING

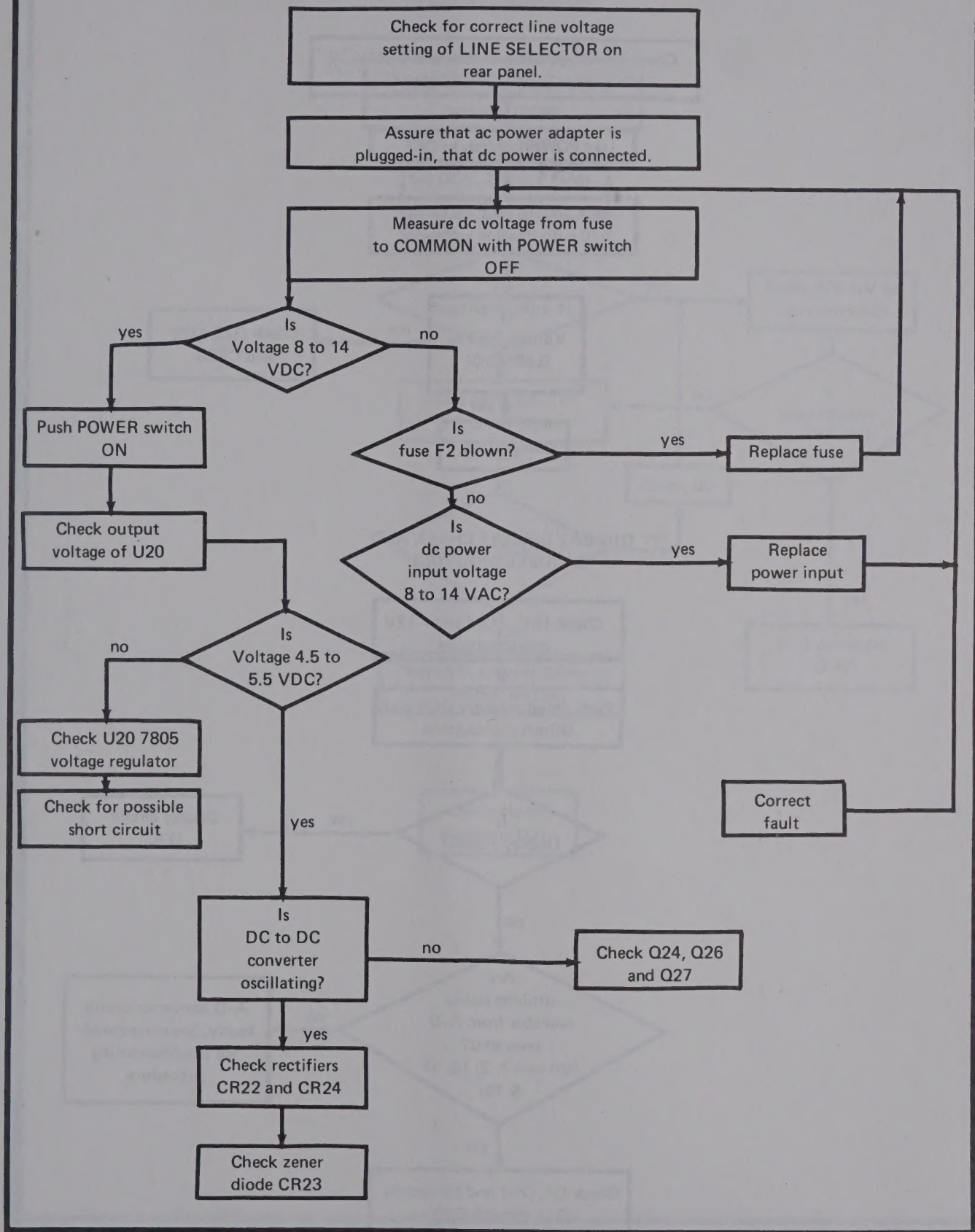
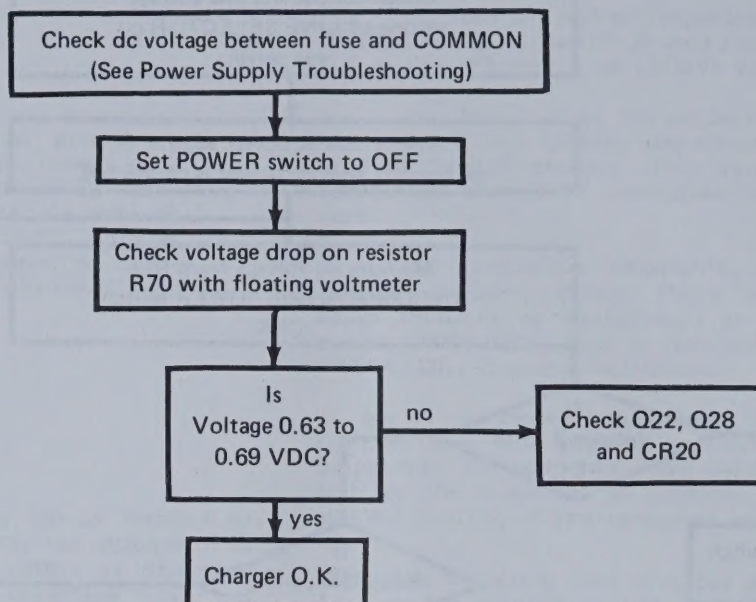


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 1 of 6)

BATTERY CHARGER CHECK AND TROUBLESHOOTING



DISPLAY CIRCUIT CHECK AND TROUBLESHOOTING

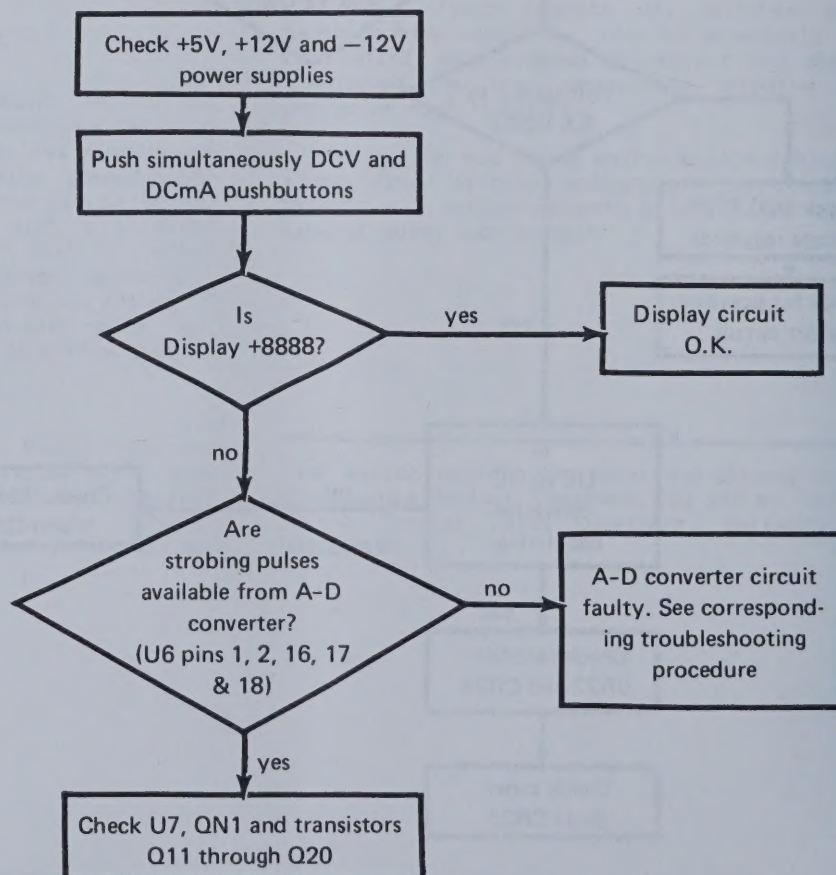


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 2 of 6)

A TO D CONVERTER CHECK AND TROUBLESHOOTING

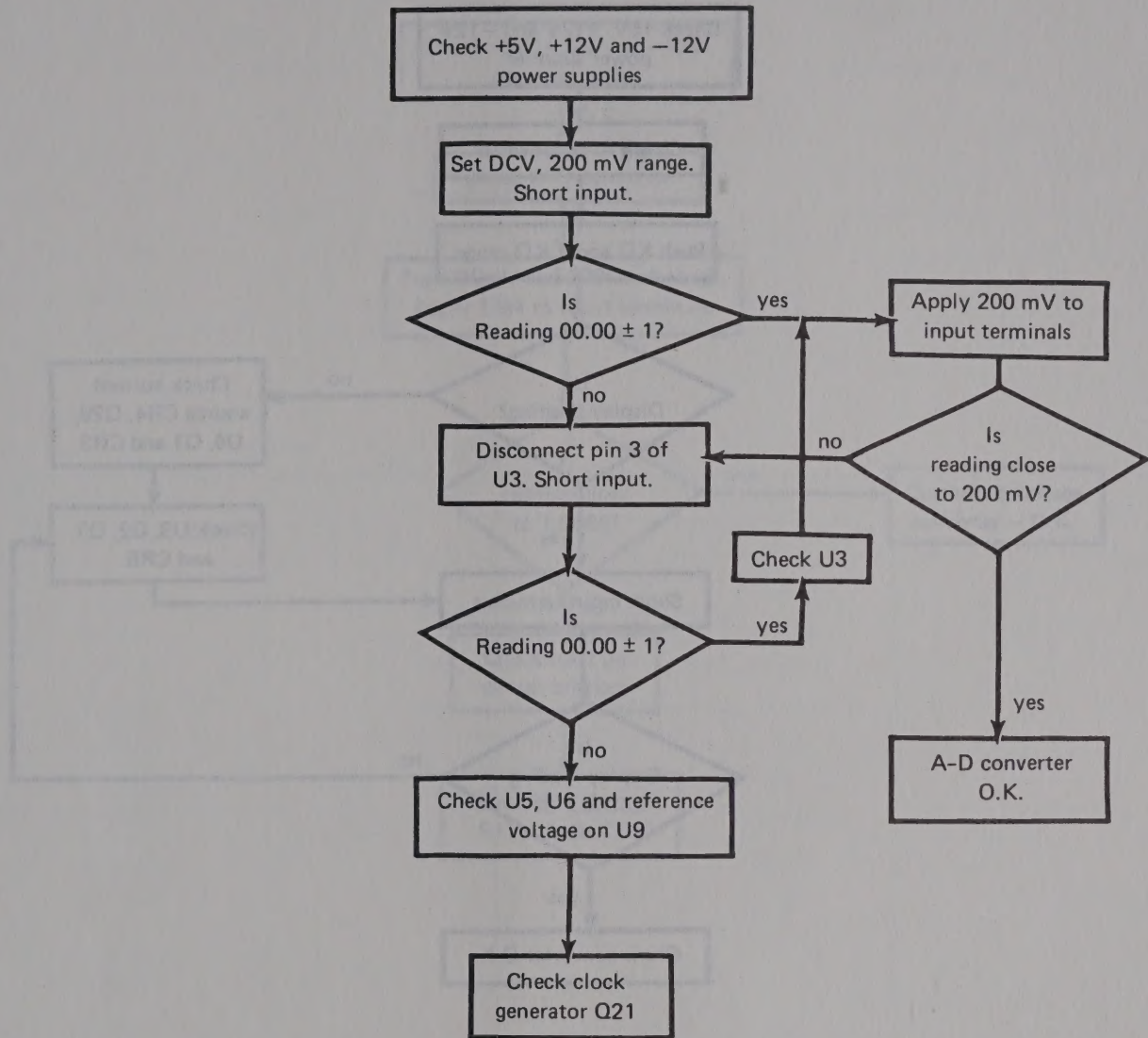


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 3 of 6)

OHMS CONVERTER CHECK AND TROUBLESHOOTING

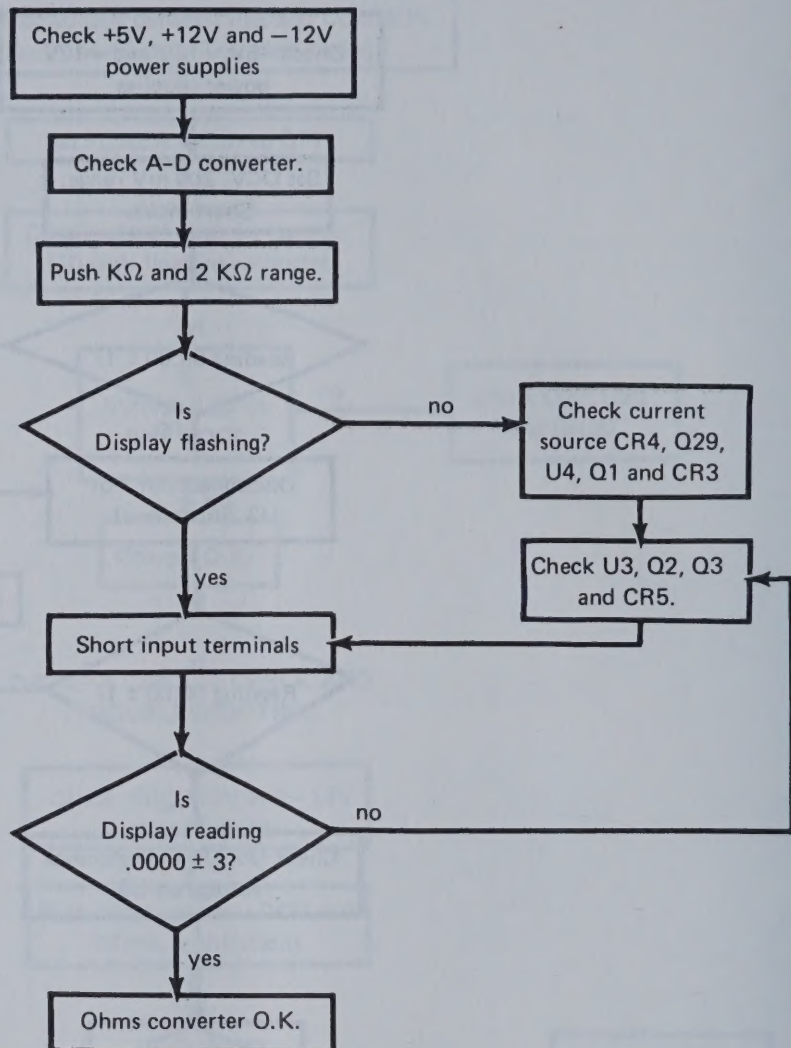


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 4 of 6)

CURRENT TO VOLTAGE CONVERTER CHECK AND TROUBLESHOOTING

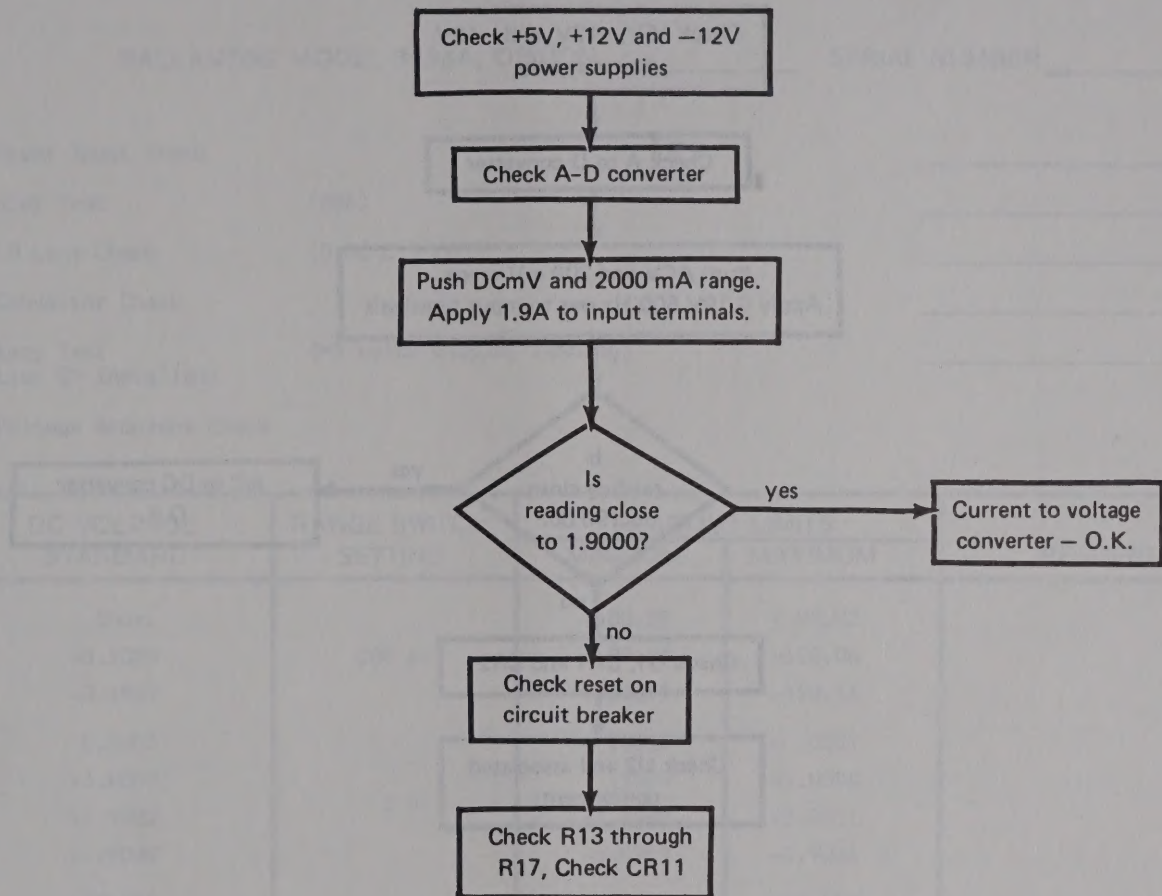


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 5 of 6)

AC TO DC TRUE RMS CONVERTER
CHECK AND TROUBLESHOOTING

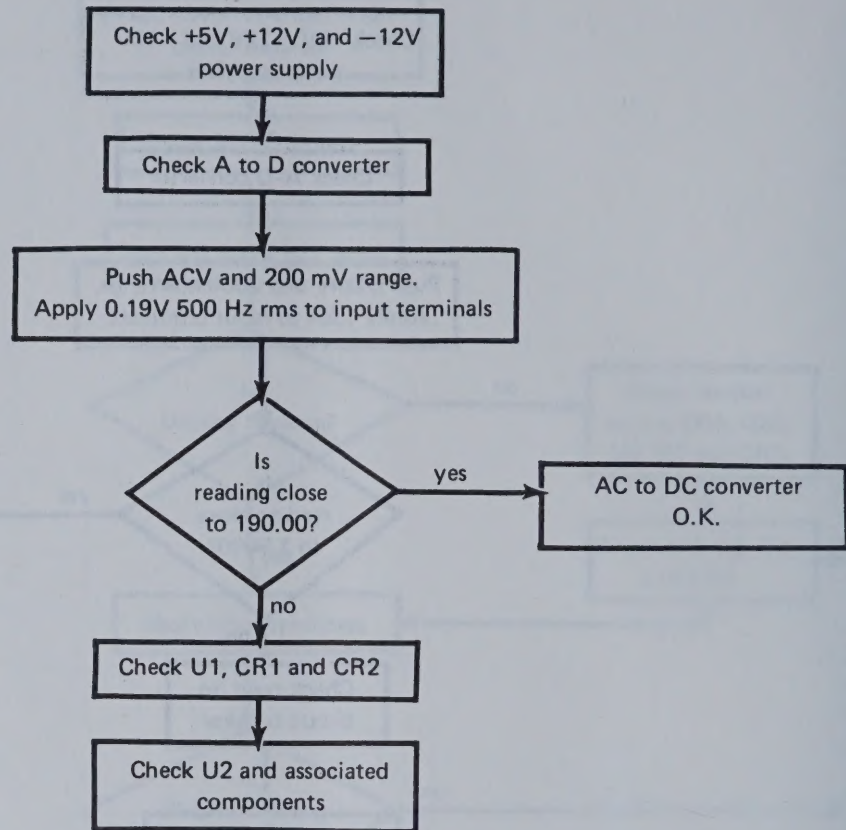


Figure 5-2. TROUBLESHOOTING & FAULT FINDING HINTS. (Sheet 6 of 6)

PERFORMANCE TEST RECORD

MODEL 3036A

BALLANTINE MODEL 3036A, OPTION _____ SERIAL NUMBER _____

- | | | |
|------------------------------|----------------------------|------------|
| 1. DC Power Input Check | | _____ (✓) |
| 2. Display Test | (888) | _____ (✓) |
| 3. HI/LO Line Check | (0.00 ± 3 LSD) | _____ (✓) |
| 4. AC Converter Check | | _____ (✓) |
| 5. Battery Test | (>5 volts display reading) | _____ (✓) |
| (Option 05 installed) | | |
| 6. DC Voltage Accuracy Check | | |

DC VOLTAGE STANDARD	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short		+ 00.00	+ 00.02	
+0.1000	200 mV	+ 99.94	+100.06	
+0.1900		+189.89	+190.11	
0.0000		+ .0000	+ .0002	
+1.0000	2 V	+ .9994	+1.0006	
+1.9000		+1.8989	+1.9011	
-1.9000		-1.8989	-1.9011	
+10.000	20 V	+ 9.994	+10.006	
+19.000		+18.989	+19.011	
+100.00		+ 99.94	+100.06	
+190.00	200 V	+189.89	+190.11	
+ 500.0		+ 499.6	+ 500.4	
+1000.0		+ 999.4	+1000.6	

7. DC Current Accuracy Check

DC CURRENT INPUT (Milliamps)	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short		+ 00.00	+ 00.03	
+0.1000	200 uA	+ 99.77	+100.23	
+0.1900		+189.59	+190.41	
-0.1900		-189.59	-190.41	
+1.0000	2 mA	+ .9977	+1.0023	
+1.9000		+1.8959	+1.9041	
+19.000		+18.959	+19.041	
+190.00	200 mA	+189.59	+190.41	
+1900.0		+1895.9	+1904.1	

8. AC Voltage Accuracy Check

AC VOLTAGE CALIBRATOR		RANGE	3036A		READING
VOLTAGE	FREQUENCY		LOW LIMIT	HIGH LIMIT	
Short	500 Hz	200 m	00.00	00.05	
100.00 mV	500 Hz	200 m	99.35	100.65	
190 mV	500 Hz	200 m	188.81	191.19	
190 mV	20 kHz	200 m	188.81	191.19	
1.900 V	30 Hz	2	1.8805	1.9195	
1.900 V	500 Hz	2	1.8881	1.9119	
1.900 V	20 kHz	2	1.8881	1.9119	
19.00 V	500 Hz	20	18.881	19.119	
19.00 V	20 kHz	20	18.881	19.119	
190.0 V	500 Hz	200	18.881	191.19	
190.0 V	20 kHz	200	188.81	191.19	
750.0 V	500 Hz	1200	745.0	755.0	
750.0 V	10 kHz	1200	742.0	758.0	
750.0 V	20 kHz	1200	N/A	N/A	

9. Resistance Accuracy Check

STANDARD RESISTANCE	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short	200 Ω	00.00	00.02(set)	
1.9 K Ω	2 K Ω	1.8978	1.9022	
19 K Ω	20 K Ω	18.978	19.022	
190 K Ω	200 K Ω	189.78	190.22	
1.9 K Ω	2000 K Ω	1897.8	1902.2	
19 M Ω	20 M Ω	18.959	19.041	

10. 1 kV COMMON to CASE Test (operation only) _____ (☒)

11. Options Check; Option _____ Option _____ Option _____ (☒)

12. Mechanical Check _____ (☒)

TECHNICIAN _____

DATE _____

PERFORMANCE TEST RECORD

MODELS 3036B & 3036B-968

SERIAL NUMBER _____

1. Power Supply Check
 - + 5 V _____ (✓)
 - + 12 V _____ (✓)
 - 12 V _____ (✓)
2. Battery Charger Check (968 or 05 Option)
 - R70 1.5Ω _____ (✓)
 - Voltage across R70 (.55 - .65) _____ (✓)
3. Line Select Check (968 only)
 - 100 V _____ (✓)
 - 120 V _____ (✓)
 - 220 V _____ (✓)
 - 240 V _____ (✓)
4. Line Regulation Check
 - 103.5 V to 126.5 V _____ (✓)
5. Display Check and Battery Check
 - Display Check _____ (✓)
 - (968 or 05 Option) Battery Check _____ (✓)
6. DC Voltage Accuracy Check

DC VOLTAGE STANDARD	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short		+ 00.00	+ 00.02	
+0.1000	200 mV	+ 99.94	+100.06	
+0.1900		+189.92	+190.08	
0.0000		+ .0000	+ .0002	
+1.0000	2 V	+ .9994	+1.0006	
+1.9000		+1.8992	+1.9008	
-1.9000		-1.8992	-1.9008	
+10.000	20 V	+ 9.994	+10.006	
+19.000		+18.992	+19.008	
+100.00	200 V	+ 99.94	+100.06	
+190.00		+189.92	+190.08	
+ 500.0	1200 V	+ 499.5	+ 500.5	
+1000.0		+ 999.4	+1000.6	

7. DC Current Accuracy Check

DC CURRENT INPUT (Milliamps)	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short		+ 00.00	+ 00.03	
+0.1000	200 μ A	+ 99.87	+100.13	
+0.1900		+189.78	+190.22	
-0.1900		-189.78	-190.22	
+1.0000	2 mA	+ .9987	+1.0013	
+1.9000		+1.8978	+1.9022	
+19.000	20 mA	+18.978	+19.022	
+190.00	200 mA	+189.78	+190.22	
+1900.0	2000 mA	+1897.8	+1902.2	

8. AC Voltage Accuracy Check

AC VOLTAGE CALIBRATOR		RANGE	3036B/B-968		READING
VOLTAGE	FREQUENCY		LOW LIMIT	HIGH LIMIT	
Short	500 Hz	200 m	00.00	00.05	
100.00 mV	500 Hz	200 m	99.50	100.50	
190 mV	500 Hz	200 m	189.32	190.68	
190 mV	20 kHz	200 m	188.75	191.25	
1.900 V	30 Hz	2	1.8780	1.9220	
1.900 V	500 Hz	2	1.8932	1.9068	
1.900 V	20 kHz	2	1.8875	1.9125	
19.00 V	500 Hz	20	18.932	19.068	
19.00 V	20 kHz	20	18.875	19.125	
190.0 V	500 Hz	200	189.32	190.68	
190.0 V	20 kHz	200	188.75	191.25	
750.0 V	500 Hz	1200	747.0	753.0	
750.0 V	10 kHz	1200	747.0	753.0	
750.0 V	20 kHz	1200	744.7	755.3	

9. Resistance Accuracy Check

STANDARD RESISTANCE	RANGE SWITCH SETTING	READOUT LIMITS		READING
		MINIMUM	MAXIMUM	
Short	200 Ω	00.00	00.02(set)	
1.9 K Ω	2 K Ω	1.8990	1.9010	
19 K Ω	20 K Ω	18.990	19.010	
190 K Ω	200 K Ω	189.90	190.10	
1.9 K Ω	2000 K Ω	1898.1	1901.9	
19 M Ω	20 M Ω	18.981	19.019	

10. Open Circuit Voltage on all Ranges < 5 volts

(✓)

11. 500 V COMMON to CASE Test (B-968)

(✓)

1 kV COMMON to CASE Test (3036B)

(✓)

TECHNICIAN _____

DATE _____

SECTION 6

PARTS LIST & CIRCUIT DIAGRAMS

The replacement parts listed are available from the vendors listed or from Ballantine Laboratories. Your local Ballantine Field Engineering Representative may also carry a stock of parts and can assist you. If pricing quotations are required for parts and/or repairs, your local representative will give the most rapid service or you may contact the Ballantine Factory directly.

When ordering replacement parts always give the following information:

- a) Instrument Model number
- b) Serial number
- c) Ballantine Part number
- d) Schematic Symbol number
- e) Identification and description of part

Ballantine will do its best to improve the instrument and make changes in style of components and replacement parts. Replacement parts may differ in appearance from those found in your instrument but are always equal or superior in performance. Where necessary minor mechanical modifications may be required in the replacement of the components.

Parts are generally available locally for most replacements. The parts list calls out the recommended vendors where applicable.

Alternate components may be substituted but the use of parts specified in this parts list is recommended. A part similar to the part initially installed at the factory may be used, i.e., a 5% composition resistor may be replaced with a similar part or a 5% film resistor or the preferred 1% metal film resistor. Use of the preferred component will always simplify calibration and speed repairs.

Selected components are identified in this manual and may be replaced with a similar valued part

unless re-selection is required due to replacement or change of a related part. The schematics and calibration procedures identify selected components and replacement procedures.

The Manufacturer Code is taken from Federal Supply Code Cataloging Handbooks H4-1, H4-2, and H4-3. Ballantine Code is 50423.

The following parts coding are used:

CVC	Capacitor, Variable, Ceramic
CCT	Capacitor, Ceramic, Tubular
CFP	Capacitor, Fixed, Plastic
CCD	Capacitor, Ceramic, Disc
CYF	Capacitor, Mylar, Foil
CMD	Capacitor, Mica, Dipped
CMM	Capacitor, Mica, Molded
CEA	Capacitor, Electrolytic, Aluminum
CET	Capacitor, Electrolytic, Tantalum
DGP	Diode, General Purpose
DZG	Diode, Zener, General Purpose
DRP	Diode, Bridge, Power
FLT	Filter
ICP	Integrated Circuit
TRQ	Transistor
RFF	Resistor, Fixed, Film
RFC	Resistor, Fixed, Composition
RVC	Resistor, Variable, Composition
RFW	Resistor, Fixed, Wirewound
SWC	Switch
LMP	Lamp
TRX	Transformer

Resistors may generally be replaced by Corning Electronics (CCW) type N-55, N-60 and C-32. Allen Bradley carbon composition resistors type EB may also be used but should generally be avoided (except for emergency replacements) in favor of the preferred part listed in this parts list.

PARTS LIST, MODEL 3036A MAIN PWB ASSEMBLY (89-40312-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...1	07-10484-0A	CYF 68.0NF 1.0 KV +-20%	050423	STET-TR. MKT-1813-368/10
C...2	07-10268-0A	CVG 5-18PF 1.0 KV GLASS TR	050423	TABOR 15005030
C...3	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...4	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...5	07-09581-0A	CET 2.2UF 35 V K 10%	050423	KEM TYP K2R2C35K
C...6	07-10087-0A	CMD 390.0PF 100 VIJ	084171	ARCO TYPE RDM15-391J
C...7	07-10599-0A	CMD 5.6NF 300V 5%		CDE CD19FC562J03 DR EQUIV.
C...8	07-10338-0A	CBM 33.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A33K
C...9	07-10340-0A	CBM 22.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A22K
C...10	07-10354-0A	CMD 1.0NF 500.0 V +- 1%	084171	ARCO DM-19-E-D-1000-F-N-U
C...11	07-10301-0A	CBM 680.0NF 63.0 VJ	050587	PLESSEY 161 SER MINIBOX
C...12	07-10103-0A	CMD 250.0PF 500 V +-5%	084171	ELMENCO DM1525J
C...13	07-09564-0A	CCD 5 NF 1 KV M 20%	056289	SPG TYP 5G1-D50
C...14	07-09571-0A	CCD 50 NF 50 V	071590	CTL TYP CK503
C...16	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...17	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...18	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...20	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...21	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...23	07-10009-0A	CCD 2.2NF 500 V DISC	073345	AMPEREX C0238501E222P
C...24	07-10093-0A	CEA 100.0UF 16 V UPPC MNT	000000	STET-TRUSH ERD EK100/16
C...25	07-10092-0A	CEA 470.0UF 35. V	000000	STET-TRUSH ERD EKG470/35
C...27	07-10012-0A	CMD 100.0 PF 500V J DIP MICA	084171	ARCO TYPE RDM15-101J
C...28	07-10183-0A	CET 47.0UF 20.0 VM DIP TAN	056289	SPRAGUE 196D476X0020PE4
C...30	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...32	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...35	07-10496-0A	CCD 100.0NF 50.0 V	000000	CAPAR CCD .1UFYFZ 50V
CR...1	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...2	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...3	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...4	05-10110-0A	DZG 1N4571 6.2V 1MA	004713	MOT 1N4571
CR...5	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR.10	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR.11	05-09469-0A	DGP MDA920A-2 50 1A	004713	MOT BRIDGE REC
CR.12	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR.20	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR.21	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR.22	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR.23	05-10066-0A	DZG 1N 759 12 20M .4	004713	MOT SI
CR.24	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR.25	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
L...1	03-10056-0A	CIL .33MH INDUCTOR	083125	NYTRONICS WEE330
Q...1	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
Q...2	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
Q...3	10-10152-0A	TRQ MP5A92 300V 30MA TO92	000000	MOTOROLA
Q...4	10-10130-0A	TRQ E108 N J FET TO-106	017856	SILICONIX E108 AOS=BOHMS
Q...5	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...6	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...7	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...8	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...9	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...10	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...11	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...12	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...13	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...14	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...15	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...16	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...17	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...18	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...19	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...20	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...22	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
Q...23	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
Q...24	10-09457-0A	TRQ 2N4918 PNP 1 40 P	004713	30 3M 20
Q...26	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...27	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...28	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
Q...29	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
GN...1	10-10133-0A	TRQ CA3081 NPN 7 16V S16DIP	086684	RCA 0.5W 70
R...1	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	016299	CGW RN60D 5623 F
R...5	09-10004-0A	RVF 100.0 0.5 W M	073138	HEL TYP 72PM
R...6	12-13124-0A	RFF 8.95K 500.0MW B	016299	CGW RN60E 25PPM
R...8	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM
R...9	12-13341-0A	RFC 47K 2.0W+-5%	001121	AB TYPE GB
R...10	12-13126-0A	RFF 9.0 K 500.0MW B	016299	CGW RN60E 25 PPM
R...11	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM
R...12	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R...13	12-12835-0A	RFW 900.0 2.0 W 0.1%	091637	DALE RS-2C DR EQUIV
R...14	12-12836-0A	RFW 90.0 2.0 W 0.1%	091637	DALE RS-2C DR EQUIV

PARTS LIST, MODEL 3036A MAIN PWB (89-40312-1A) - CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
R. 15	12-12837-0A	RFW 9.0 2.0 W 0.1%	091637	DALE RS-2C OR EQUIV
R. 16	12-12838-0A	RFW 0.9 2.0 W 0.1%	091637	DALE RS-2C OR EQUIV
R. 19	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 20	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 21	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 22	12-12300-0A	RFF 1.0 K 250.0MW F+-1%	016299	CGW RN55D 1001 F
R. 23	12-12378-0A	RFF 6.49K 250.0MW F+- 1%	016299	CGW RN55D 6491 F
R. 24	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 26	12-12862-0A	RFC 560.0 K 2.0 W 5%	001121	A-B HB
R. 27	12-12873-0A	RFC 560.0 K 500.0MW	001121	A-B TYPE E-B
R. 28	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 29	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 30	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 31	12-13127-0A	RFF 75.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 32	09-10278-0A	RVF 2.0 K 500.0MW 18T VERT		HELIPOT 68WR2K OR EQUIV.
R. 33	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	016299	CGW RN55D 6192 F
R. 34	12-12464-0A	RFF 46.4 K 250.0MW F+- 1%	016299	CGW RN55D 4642 F
R. 35	12-13128-0A	RFF 100.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 36	12-13129-0A	RFF 10.9 K 500.0MW B	016299	CGW RN60E 25PPM
R. 37	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 38	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 39	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 40	12-06107-0A	RFC 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 41	12-06107-0A	RFC 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 42	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	016299	CGW RN55D 4641 F
R. 43	12-01224-0A	RFC 2.7 250.0MW K+-10%	001121	A-B TYP CB
R. 44	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	016299	CGW RN60D 5623 F
R. 45	09-10134-0A	RVF 50.0 K 0.5 W +-30%	073138	HELIPOT 72PM
R. 46	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 49	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 50	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 51	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 52	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 53	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 54	12-01085-0A	RFC 120.0 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 55	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 56	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 58	12-12180-0A	RFF 68.1 250.0MW F+- 1%	016299	RN55D 68R1 F
R. 59	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 60	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 61	12-13157-0A	RFF 90.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 62	12-13130-0A	RFF 10.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 63	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 64	12-08954-0A	RFC 6.8 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 65	09-10195-1B	RVC 5.0 K+-30% LIN 1/B SH	050423	CTS XBE 270 50K +- 30%
R. 66	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 70	12-01265-0A	RFC 3.9 1.0 W K+-10%	001121	A-B TYP CB
R. 71	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 72	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 73	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 74	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 75	12-01242-0A	RFC 330.0 250.0MW K+-10%	001121	A-B TYP CB
R. 76	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 78	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 79	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 80	12-08046-0A	RFC 10.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 81	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 83	12-13339-0A	RFC 36.0 OHM 2.0W 5%	001121	AB TYPE HB
R. 94	12-12529-0A	RFF 200.0 K 250.0MW F+-1%	016299	CGW RN55D 2003 F
R. 95	12-12224-0A	RFF 178.0 250.0MW F+-1%	016299	CGW RN55D 1780 F
RN. 1	13-10006-0A	RNF 2.0 K 250.0MW B7RES DIP	080053	BECKMAN 899-3-R 2.0K
RN. 2	13-10044-0A	RNF 100.0 14 1.5W 14DIP 7R	080053	BECKMAN 899-3-R100
S. .0	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .1	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .2	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .3	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .4	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .5	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .6	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. .7	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. .8	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. .9	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 10	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 11	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
T. .2	20-40062-0A	TRX 3036A DC/DC CONVERTER	050423	TABOR
U. .1	24-10212-0A	ICP CA3140G FET OP AM MINIDIP	086684	RCA CA3140G FET OPAMP MINIDIP
U. .2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	024355	ANALOG DEVICES AD536J
U. .5	24-10210-1A	ICP LD120CJ MOD DVM .005%	050423	SILICONIX-ANALOG
U. .6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	086664	SILICONIX-ANALOG
U. .7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	002413	MOTOROLA OR EQUIV
U. .8	24-10255-0A	ICP MC14512 MULTIPLEXER	004713	MOTOROLA MC14512
U. .9	24-10256-0A	ICP REF-02C 25PPM VOLT REF	000000	PMI REF-02C
U. 20	24-10153-0A	ICP UA7805 5V REG.	007263	FAIRCHILD UA7805UC

PARTS LIST, MODEL 3036A 2 VOLT AUTO ZERO ASSEMBLY (89-11255-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C..31	07-02236-0A	CMM 200 PF 500 V J 5%	084171	ARCO TYPE CM15-E-201-J
Q..30	10-10005-0A	TRQ MPS6515 NPN 1 25 PTO-92	004713	MOT .350 390M 150
R..90	09-10113-0A	RVF 100.0 K 500.0MW PC TRIM	073138	HEL TYPE 91W
R..91	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	016299	CGW RN55D 4641 F
R..92	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	016299	CGW RN55D 1002 F
R..93	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	016299	CGW RN55D 1002 F

PARTS LIST, MODEL 3036A DISPLAY BOARD ASSEMBLY (89-40310-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
DS..1	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..2	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..3	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..4	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..5	21-10041-0A	IND 0.43 IN. HIEF. RED CC +-1	028480	HP 5082-7656 COMMON CAT.
R..63	12-12164-0A	RFF 46.4 250.0MW F+- 1%	016299	RN55D 46R4 F

PARTS LIST, MODEL 3036A FRONT PANEL ASSEMBLY (89-10766-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
J..1	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J..2	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J..4	31-10133-0A	BPS 10MM BLACK	050423	BLI ELMA INTERLK 024-2020

PARTS LIST, MODEL 3036A REAR PANEL ASSEMBLY (89-10765-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
F..1A	19-09500-0A	FSH FUSE MTG.	075915	LITTELFUSE #357001
J..50	31-10170-0A	REC 5 PIN BLKHD MT LOCK	082389	SSWITCHCRAFT 61HA5F
R...1	19-10047-0A	FSH 1.0A NORMAL -BLO	075915	LITTELFUSE 312001

PARTS LIST, MODEL 3036A PARTS KIT ASSEMBLY (89-11260-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
RN..3	13-10117-1B	RNF 3036 ATTENUATOR NETWORK	050423	CADDOCK SPECIAL

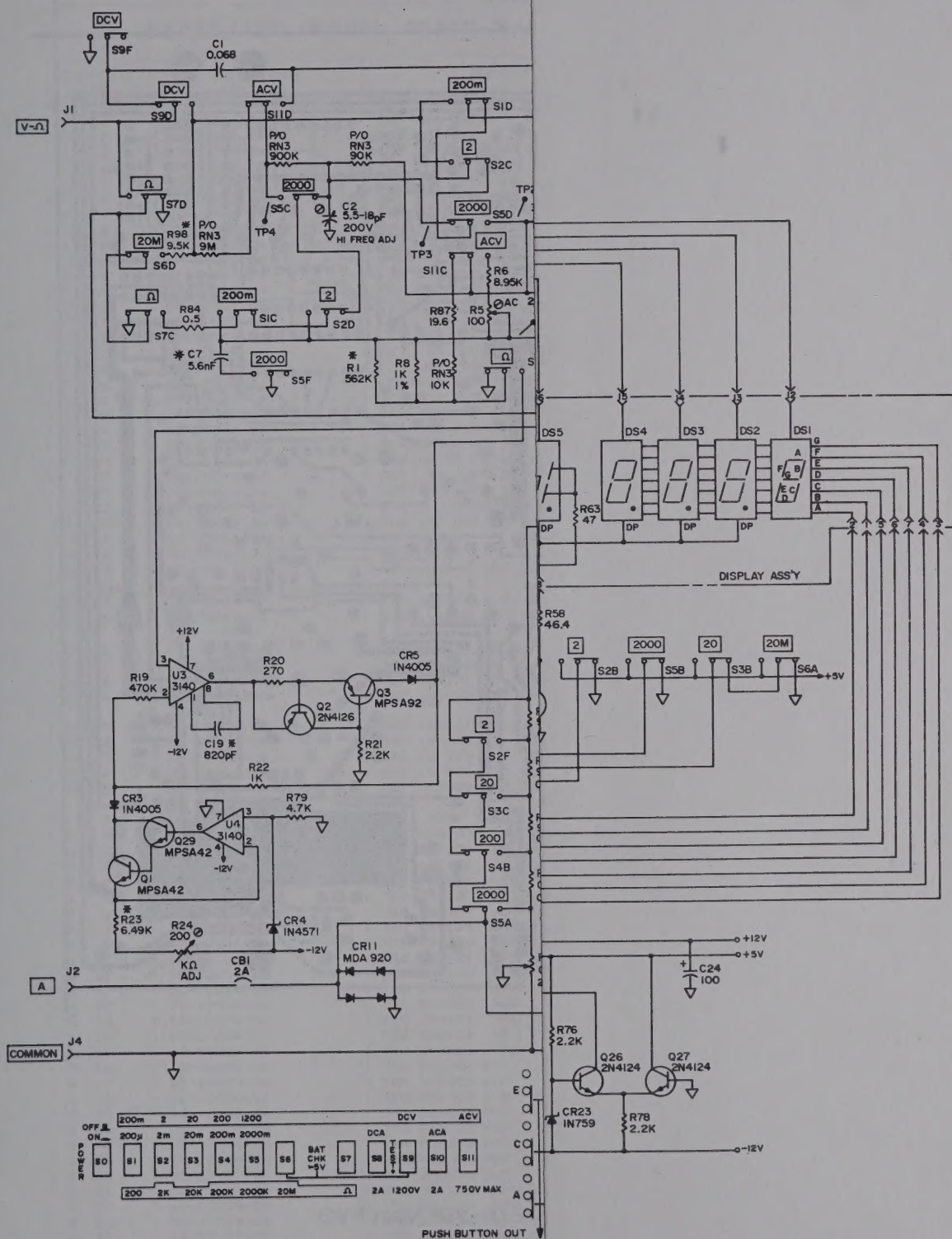


Figure 6-1. Model 3036A, 4 1/2 Digit DMM, Schematic Diagram

PARTS LIST, MODEL 3036A 2 VOLT AUTO ZERO ASSEMBLY (89-11255-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C..31	07-02236-0A	CMM 200 PF 500 V J 5%	084171	ARCO TYPE CM15-E-201-J
Q..30	10-10005-0A	TRQ MPS6515 NPN 1 25 PTO-92	004713	MOT .350 390M 150
R..90	09-10113-0A	RVF 100.0 K 500.0MW PC TRIM	073138	HEL TYPE 91W
R..91	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	016299	CGW RN55D 4641 F
R..92	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	016299	CGW RN55D 1002 F
R..93	12-12400-0A	RFF 10.0 K 250.0MW F+- 1%	016299	CGW RN55D 1002 F

PARTS LIST, MODEL 3036A DISPLAY BOARD ASSEMBLY (89-40310-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
DS..1	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..2	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..3	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..4	21-10046-0A	UBD 0.43 IN HI-EFF RED C. A. 00	028480	HP 5082-7650
DS..5	21-10041-0A	IND 0.43 IN. HIEF. RED CC +-1	028480	HP 5082-7656 COMMON CAT.
R..63	12-12164-0A	RFF 46.4 250.0MW F+- 1%	016299	RN55D 46R4 F

PARTS LIST, MODEL 3036A FRONT PANEL ASSEMBLY (89-10766-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
J..1	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J..2	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J..4	31-10133-0A	BPS 10MM BLACK	050423	BLI ELMA INTERLK 024-2020

PARTS LIST, MODEL 3036A REAR PANEL ASSEMBLY (89-10765-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
F..1A	19-09500-0A	FSH FUSE MTG.	075915	LITTELFUSE #357001
J..50	31-10170-0A	REC 5 PIN BLKHD MT LOCK	082389	SSWITCHCRAFT 61HA5F
R...1	19-10047-0A	FSH 1.0A NORMAL -BLO	075915	LITTELFUSE 312001

PARTS LIST, MODEL 3036A PARTS KIT ASSEMBLY (89-11260-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
RN..3	13-10117-1B	RNF 3036 ATTENUATOR NETWORK	050423	CADDOCK SPECIAL

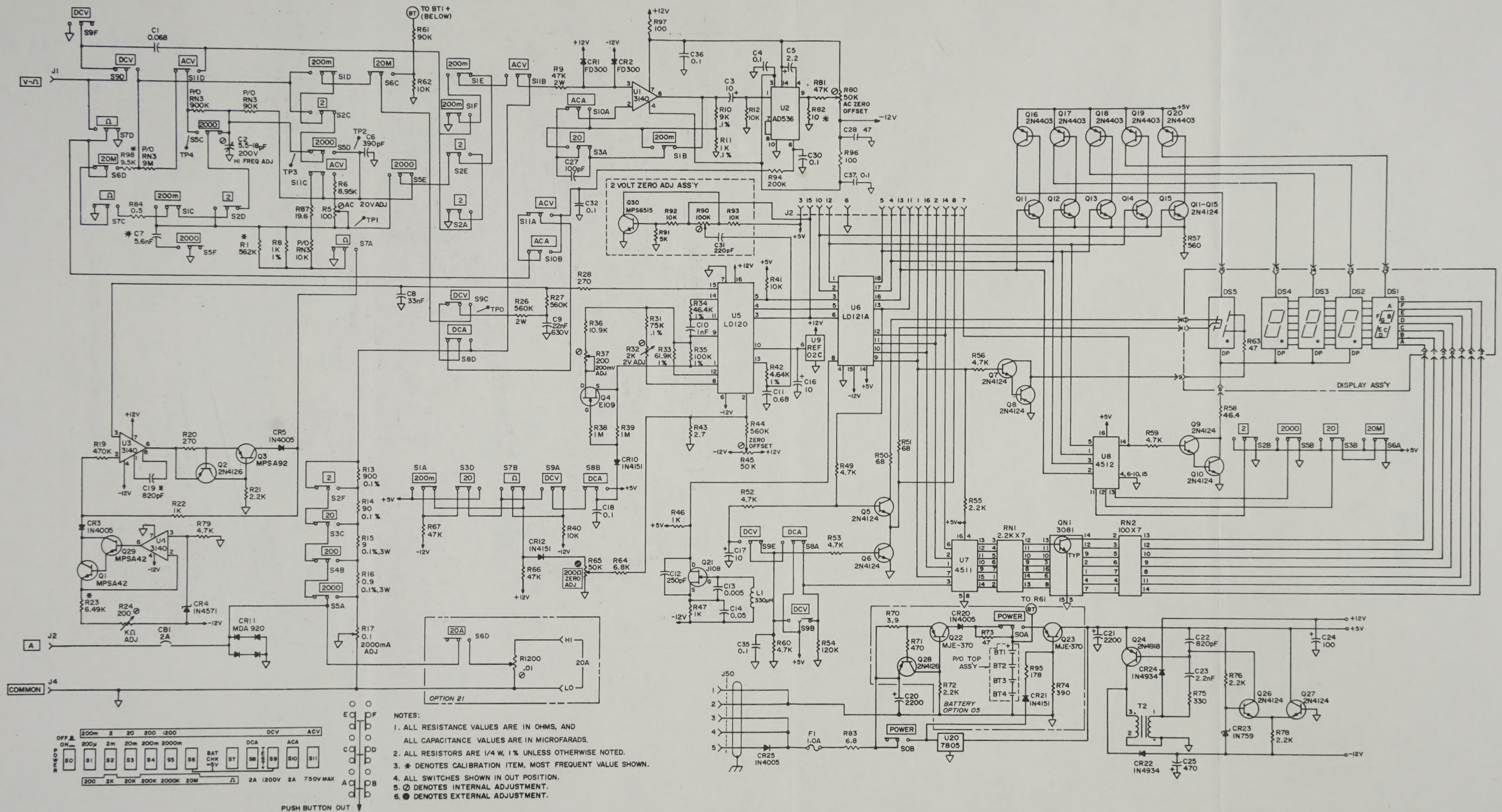


Figure 6-1. Model 3036A, 4 1/2 Digit DMM, Schematic Diagram

REDUCE TO
7.690 ±.01

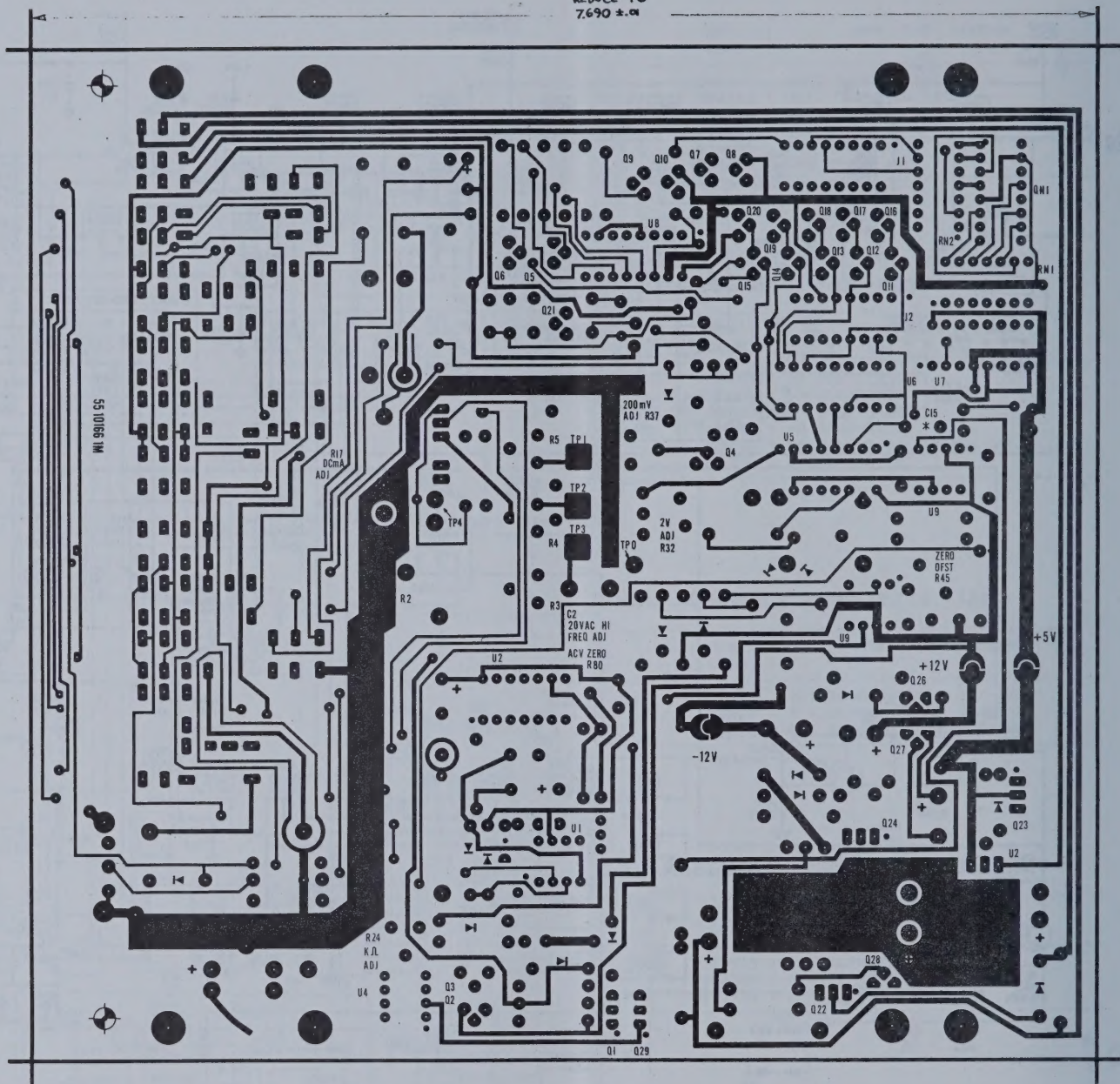


Figure 6-2. Model 3036A/B/B-968 Main PWB

PARTS LIST, MODEL 3036B MAIN PWB ASSEMBLY (89-40313-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...1	07-10484-0A	CYF 68.0NF 1.0 KV +-20%	050423	STET-TR. MKT-1813-368/10
C...2	07-10268-0A	CVG 5-18PF 1.0 KV GLASS TR	050423	TABOR 15005030
C...3	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...4	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...5	07-09581-0A	CET 2.2UF 35 V K 10%	050423	KEM TYP K2R2C35K
C...6	07-10087-0A	CMD 390.0PF 100 VIJ	084171	ARCO TYPE RDM15-391J
C...7	07-10599-0A	CMD 5.6NF 300V 5%		CDE CD19FC562J03 OR EQUIV.
C...8	07-10338-0A	CBM 33.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A33K
C...9	07-10340-0A	CBM 22.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A22K
C...10	07-10354-0A	CMD 1.0NF 500.0 V +-1%	084171	ARCO DM-19-E-D-1000-F-N-U
C...11	07-10301-0A	CBM 680.0NF 63.0 VJ	050587	PLESSEY 161 SER MINIBOX
C...12	07-10103-0A	CMD 250.0PF 500 V +-5%	084171	ELMENCO DM1525J
C...13	07-09564-0A	CCD 5 NF 1 KV M 20%	056289	SPG TYP 5G1-D50
C...14	07-09571-0A	CCD 50 NF 50 V	071590	CTL TYP CK503
C...16	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...17	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...18	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...20	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...21	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...23	07-10009-0A	CCD 2.2NF 500 V DISC	073345	AMPEREX C0238501E222P
C...24	07-10093-0A	CEA 100.0UF 16 V UPPC MNT	000000	STET-TRUSH ERO EK100/16
C...25	07-10092-0A	CEA 470.0UF 35 V	000000	STET-TRUSH ERO EGK470/35
C...27	07-10012-0A	CMD 100.0 PF 500V J DIP MICA	084171	ARCO TYPE RDM15-101J
C...28	07-10183-0A	CET 47.0UF 20.0 VM DIP TAN	056289	SPRAGUE 196D476X0020PE4
C...30	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...32	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...35	07-10496-0A	CCD 100.0NF 50.0 V	000000	CAPAR CCD 1UFYFZ 50V
CR...1	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...2	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...3	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...4	05-10110-0A	DZG 1N4571 6.2V 1MA	004713	MOT IN4571
CR...5	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...10	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...11	05-09469-0A	DGP MDA920A-2 50 1A	004713	MOT BRIDGE REC
CR...12	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...20	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...21	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...22	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...23	05-10066-0A	DZG 1N 759 12 20M .4	004713	MOT SI
CR...24	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...25	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
L...1	03-10056-0A	CIL .33MH INDUCTOR	083125	NYTRONICS WEE330
G...1	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
G...2	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
G...3	10-10152-0A	TRQ MPSA92 300V 30MA TO92	000000	MOTOROLA
G...4	10-10130-0A	TRQ E108 N J FET TO-106	017856	SILICONIX E108 AOS=BOHMS
G...5	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...6	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...7	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...8	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...9	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...10	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...11	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...12	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...13	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...14	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...15	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...16	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...17	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...18	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...19	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...20	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...22	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
G...23	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
G...24	10-09457-0A	TRQ 2N4918 PNP 1 40 P	004713	30 3M 20
G...26	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...27	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...28	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
G...29	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
GN...1	10-10133-0A	TRQ CA3081 NPN 7 16V S16DIP	086684	RCA 0.5W 70
R...1	12-12572-0A	RFF 562.0 K 500.0MW F+-1%	016299	CGW RN60D 5623 F
R...2	09-10116-0A	RVF 100.0 K 250.0MW CERMET	073138	HELIPOT 72PM
R...3	09-10124-0A	RVF 10.0 K 250.0MW K CER	073138	HELIPOT 72PM FLAT MTG
R...4	09-10006-0A	RVC 1.0 K 0.5 W K+-10%	073138	HEL TYP 72PM
R...5	09-10004-0A	RVF 100.0 0.5 W M	073138	HEL TYP 72PM
R...6	12-13124-0A	RFF 8.95K 500.0MW B	016299	CGW RN60E 25PPM
R...8	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM

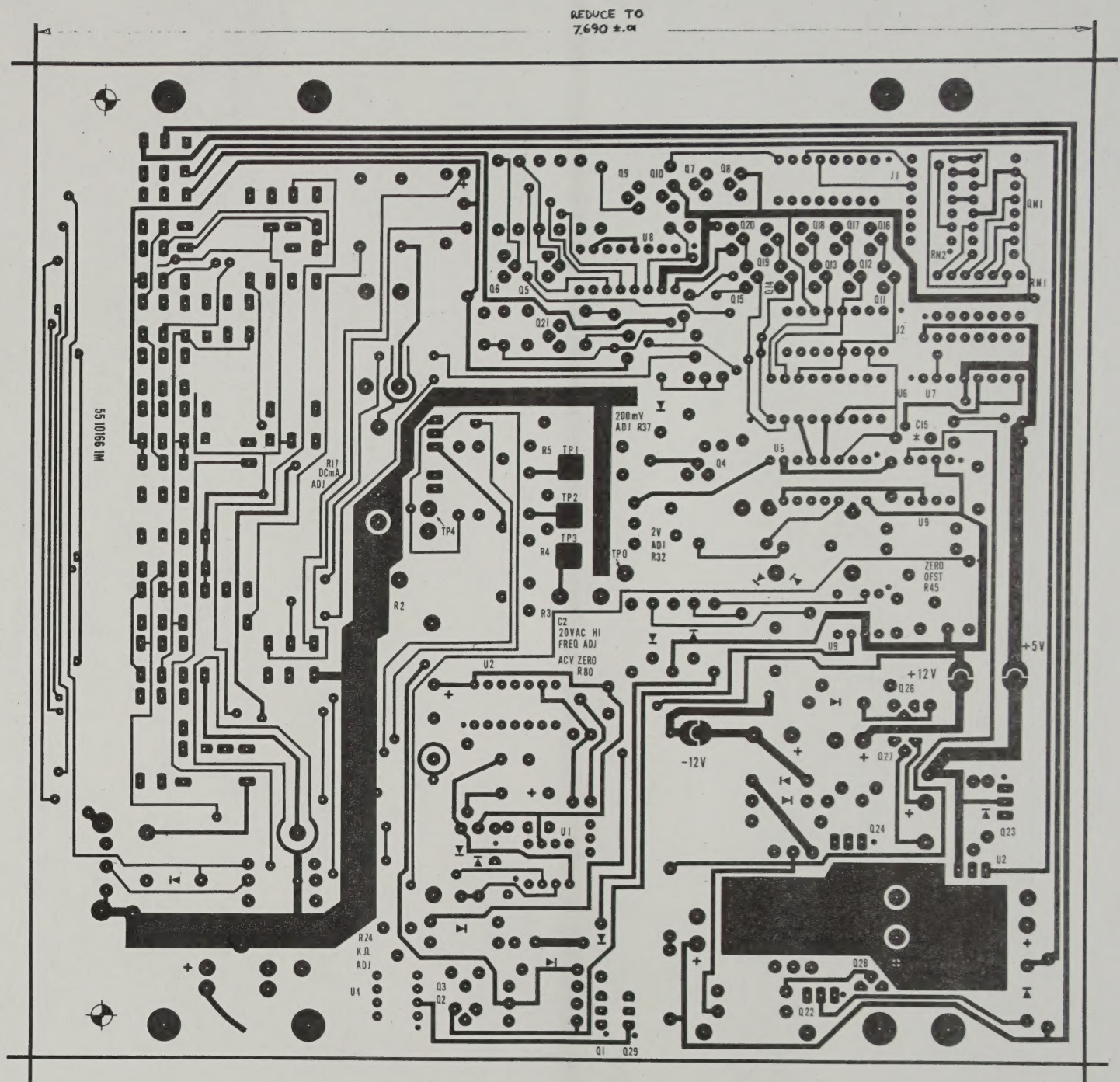


Figure 6-2. Model 3036A/B/B-968 Main PWB

PARTS LIST, MODEL 3036B MAIN PWB ASSEMBLY (89-40313-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...1	07-10484-0A	CYF 68.0NF 1.0 KV +-20%	050423	STET-TR. MKT-1813-368/10
C...2	07-10268-0A	CVG 5-18PF 1.0 KV GLASS TR	050423	TABOR 15005030
C...3	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...4	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...5	07-09581-0A	CET 2.2UF 35 V K 10%	050423	KEM TYP K2R2C35K
C...6	07-10087-0A	CMD 390.0PF 100 VIJ	084171	ARCO TYPE RDM15-391J
C...7	07-10599-0A	CMD 5.6NF 300V 5%		CDE CD19FC562J03 OR EQUIV.
C...8	07-10338-0A	CBM 33.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A33K
C...9	07-10340-0A	CBM 22.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A22K
C...10	07-10354-0A	CMD 1.0NF 500.0 V +-1%	084171	ARCO DM-19-E-D-1000-F-N-U
C...11	07-10301-0A	CBM 680.0NF 63.0 VJ	050587	PLESSEY 161 SER MINIBOX
C...12	07-10103-0A	CMD 250.0PF 500 V +-5%	084171	ELMENCO DM1525J
C...13	07-09564-0A	CCD 5 NF 1 KV M 20%	056289	SPG TYP 5G1-D50
C...14	07-09571-0A	CCD 50 NF 50 V M	071590	CTL TYP CK503
C...16	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...17	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...18	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...20	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...21	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...23	07-10009-0A	CCD 2.2NF 500 V DISC	073345	AMPEREX C0238501E222P
C...24	07-10093-0A	CEA 100.0UF 16 V UPPC MNT	000000	STET-TRUSH ERO EK100/16
C...25	07-10092-0A	CEA 470.0UF 35 V	000000	STET-TRUSH ERO EGK470/35
C...27	07-10012-0A	CMD 100.0 PF 500V J DIP MICA	084171	ARCO TYPE RDM15-101J
C...28	07-10183-0A	CET 47.0UF 20.0 VM DIP TAN	056289	SPRAGUE 196D476X0020PE4
C...30	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...32	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...35	07-10496-0A	CCD 100.0NF 50.0 V	000000	CAPAR CCD 1UFYFZ 50V
CR...1	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...2	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...3	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...4	05-10110-0A	DZG 1N4571 6.2V 1MA	004713	MOT 1N4571
CR...5	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...10	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...11	05-09469-0A	DGP MDA920A-2 50 1A	004713	MOT BRIDGE REC
CR...12	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...20	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...21	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...22	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...23	05-10066-0A	DZG 1N 759 12 20M .4	004713	MOT SI
CR...24	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...25	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
L...1	03-10056-0A	CIL .33MH INDUCTOR	083125	NYTRONICS WEE330
G...1	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
G...2	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
G...3	10-10152-0A	TRQ MPSA92 300V 30MA TO92	000000	MOTOROLA
G...4	10-10130-0A	TRQ E108 N J FET TO-106	017856	SILICONIX E108 AOS=BOHMS
G...5	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...6	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...7	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...8	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...9	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...10	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...11	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...12	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...13	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...14	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...15	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...16	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...17	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...18	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...19	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...20	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
G...22	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
G...23	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
G...24	10-09457-0A	TRQ 2N4918 PNP 1 40 P	004713	30 3M 20
G...26	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...27	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
G...28	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
G...29	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
GN...1	10-10133-0A	TRQ CA3081 NPN 7 16V S16DIP	086684	RCA 0.5W 70
R...1	12-12572-0A	RFF 562.0 K 500.0MW F+-1%	016299	CGW RN60D 5623 F
R...2	09-10116-0A	RVF 100.0 K 250.0MW CERMET	073138	HELIPOT 72PM
R...3	09-10124-0A	RVF 10.0 K 250.0MW K CER	073138	HELIPOT 72PM FLAT MTG
R...4	09-10006-0A	RVC 1.0 K 0.5 W K+-10%	073138	HEL TYP 72PM
R...5	09-10004-0A	RVF 100.0 0.5 W M	073138	HEL TYP 72PM
R...6	12-13124-0A	RFF 8.95K 500.0MW B	016299	CGW RN60E 25PPM
R...8	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM

PARTS LIST, MODEL 3036B MAIN PWB (89-40313-1A) CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
R. 9	12-13341-0A	RFC 47K 2.0W+-5%	001121	AB TYPE GB
R. 10	12-13126-0A	RFF 9.0 K 500.0MW B	016299	CGW RN60E 25 PPM
R. 11	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 12	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 13	12-13201-0A	RFW 900. 2.0 W 0.05%	091637	DALE RS-2C DR EQUIV
R. 14	12-13202-0A	RFW 90. 2.0 0.05%	091637	DALE RS-2C DR EQUIV
R. 15	12-13203-0A	RFW 9. 2.0 W 0.05%	091637	DALE RS-2C DR EQUIV
R. 16	12-13204-0A	RFW .9 2.0 W 0.05%	091637	DALE RS-2C DR EQUIV
R. 19	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 20	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 21	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 22	12-12300-0A	RFF 1.0 K 250.0MW F+-1%	016299	CGW RN55D 1001 F
R. 23	12-12378-0A	RFF 6.49K 250.0MW F+- 1%	016299	CGW RN55D 6491 F
R. 24	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 26	12-12862-0A	RFC 560.0 K 2.0 W 5%	001121	A-B HB
R. 27	12-12873-0A	RFC 560.0 K 500.0MW	001121	A-B TYPE E-B
R. 28	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 29	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 30	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 31	12-13127-0A	RFF 75.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 32	09-10278-0A	RVF 2.0 K 500.0MW 18T VERT		HELIPOT 68WR2K OR EQUIV.
R. 33	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	016299	CGW RN55D 6192 F
R. 34	12-12464-0A	RFF 46.4 K 250.0MW F+- 1%	016299	CGW RN55D 4642 F
R. 35	12-13128-0A	RFF 100.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 36	12-13129-0A	RFF 10.9 K 500.0MW B	016299	CGW RN60E 25PPM
R. 37	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 38	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 39	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 40	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 41	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 42	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	016299	CGW RN55D 4641 F
R. 43	12-01224-0A	RFC 2.7 250.0MW K+-10%	001121	A-B TYP CB
R. 44	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	016299	CGW RN60D 5623 F
R. 45	09-10134-0A	RVF 50.0 K 0.5 W +-30%	073138	HELIPOT 72PM
R. 46	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 49	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 50	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 51	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 52	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 53	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 54	12-01085-0A	RFC 120.0 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 55	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 56	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 58	12-12180-0A	RFF 68.1 250.0MW F+- 1%	016299	RN55D 68R1 F
R. 59	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 60	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 61	12-13157-0A	RFF 90.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 62	12-13130-0A	RFF 10.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 63	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 64	12-08954-0A	RFC 6.8 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 65	09-10195-1B	RVC 5.0 K+-30% LIN 1/8 SH	050423	CTS XBE 270 50K +- 30%
R. 66	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 70	12-01265-0A	RFC 3.9 1.0 W K+-10%	001121	A-B TYP GB
R. 71	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 72	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 73	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 74	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 75	12-01242-0A	RFC 330.0 250.0MW K+-10%	001121	A-B TYP CB
R. 76	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 78	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 79	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 80	12-08046-0A	RFC 10.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 81	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 83	12-13339-0A	RFC 36.0 OHM 2.0W 5%	001121	AB TYPE HB
R. 94	12-12929-0A	RFF 200.0 K 250.0MW F+-1%	016299	CGW RN55D 2003 F
R. 95	12-12224-0A	RFF 178.0 250.0MW F+-1%	016299	CGW RN55D 1780 F
RN. 1	13-10006-0A	RNF 2.0 K 250.0MW B7RES DIP	080053	BECKMAN 899-3-R 2.0K
RN. 2	13-10044-0A	RNF 100.0 14 1.5W 14DIP 7R	080053	BECKMAN 899-3-R100
S. 0	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 1	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 2	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 3	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 4	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 5	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 6	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 7	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 8	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 9	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 10	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 11	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
T. 2	20-40062-0A	TRX 3036A DC/DC CONVERTER	050423	TABOR

PARTS LIST, MODEL 3036B MAIN PWB (89-40313-1A) - CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
U...1	24-10212-0A	ICP CA3140E FET OP AM MINDIP	086684	RCA CA3140G FET OPAMP MINIDIP
U...2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	024355	ANALOG DEVICES AD536J
U...5	24-10210-1A	ICP LD120CJ MOD DVM .005%	050423	SILICONIX-ANALOG
U...6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	086664	SILICONIX-ANALOG
U...7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	002413	MOTOROLA DR EGUV
U...8	24-10255-0A	ICP MC14512 MULTIPLEXER	004713	MOTOROLA MC14512
U...9	24-10398-0A	ICP +5 VOLT REFERENCE		PMI REF-02EZ
U...20	24-10153-0A	ICP UA7805 5V REG.	007263	FAIRCHILD UA7805UC

PARTS LIST, MODEL 3036B DISPLAY BOARD ASSEMBLY (89-40310-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
DS...1	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...2	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...3	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...4	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...5	21-10041-0A	IND 0.43 IN. HIEF. RED CC +-1	028480	HP 5082-7656 COMMON CAT.
R...63	12-12164-0A	RFF 46.4 250.OMW F+- 1%	016299	RN55D 46R4 F

PARTS LIST, MODEL 3036B 2 VOLT AUTO ZERO ASSEMBLY (89-11255-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...31	07-02236-0A	CMM 200 PF 500 V J 5%	084171	ARCO TYPE CM15-E-201-J
Q...30	10-10005-0A	TRG MPS6515 NPN 1 25 PTO-92	004713	MDT .350 390M 150
R...90	09-10113-0A	RVF 100.0 K 500.OMW PC TRIM	073138	HEL TYPE 91W
R...91	12-12364-0A	RFF 4.64K 250.OMW F+- 1%	016299	CGW RN55D 4641 F
R...92	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F
R...93	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F

PARTS LIST, MODEL 3036B FRONT PANEL ASSEMBLY (89-11263-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
J...1	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...2	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...4	31-10133-0A	BPS 10MM BLACK	050423	BLI ELMA INTERLK 024-2020

PARTS LIST, MODEL 3036B REAR PANEL ASSEMBLY (89-10765-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
F...1A	19-09500-0A	FSH FUSE MTG.	075915	LITTELFUSE #357001
J...50	31-10170-0A	REC 5 PIN BLKHD MT LOCK	082389	SSWITCHCRAFT 61HA5F
R...1	19-10047-0A	FSH 1.0A NORMAL -BLO	075915	LITTELFUSE 312001

PARTS LIST, MODEL 3036B PARTS KIT ASSEMBLY (89-11260-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
RN...3	13-10117-1B	RNF 3036 ATTENUATOR NETWORK	050423	CADDOCK SPECIAL

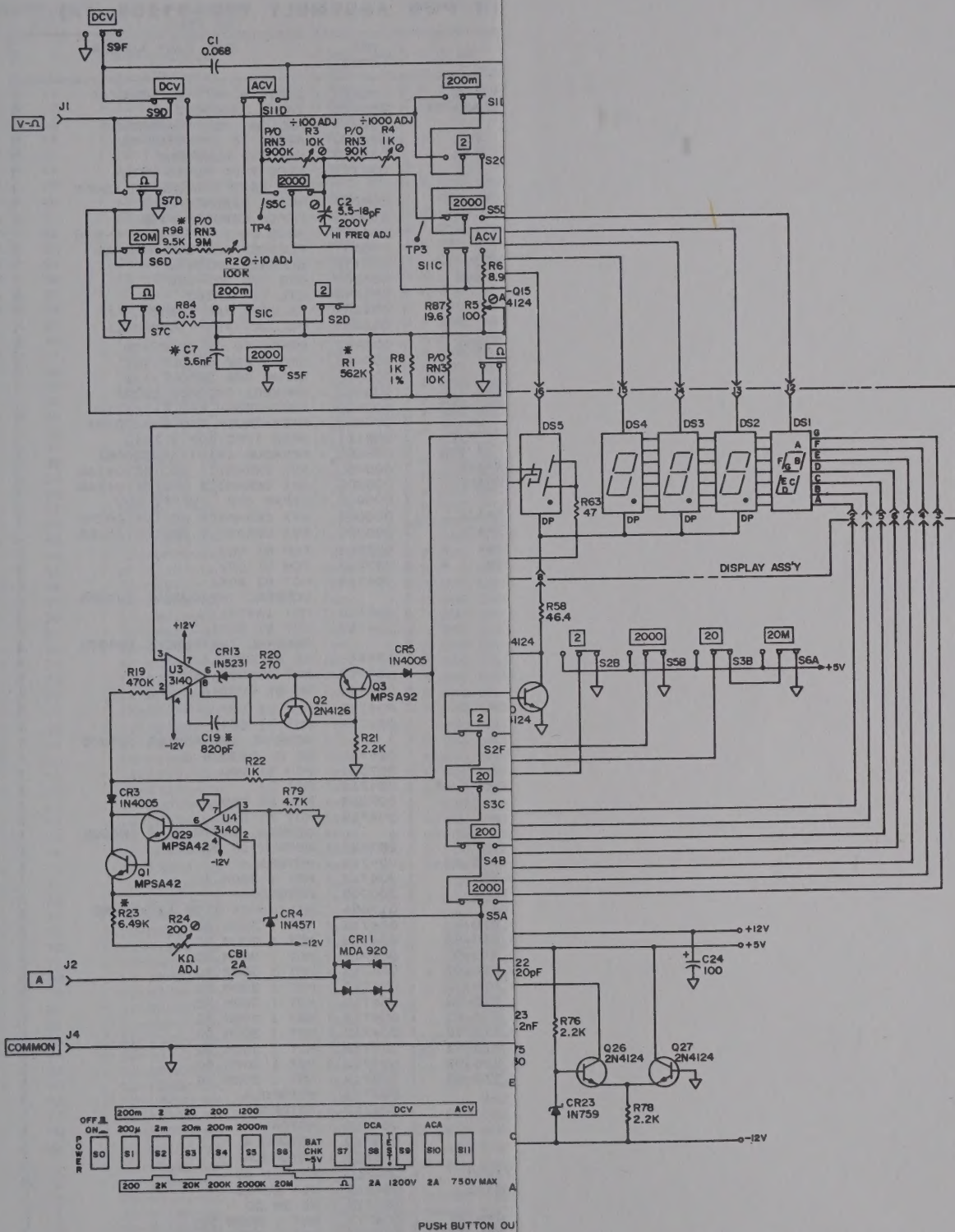


Figure 6-3. Model 3036B, 4 1/2 Digit DMM, Schematic Diagram

PARTS LIST, MODEL 3036B-968 MAIN PWB ASSEMBLY (89-11256-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...1	07-10484-0A	CYF 68.0NF 1.0 KV +-20%	050423	STET-TR. MKT-1813-368/10
C...2	07-10268-0A	CVG 5-18PF 1.0 KV GLASS TR	050423	TABOR 15005030
C...3	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...4	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...5	07-09581-0A	CET 2.2UF 35 V K 10%	050423	KEM TYP K2R2C35K
C...6	07-10087-0A	CMD 390.0PF 100 VIJ	084171	ARCO TYPE RDM15-391J
C...7	07-10599-0A	CMD 5.6NF 300V 5%		CDE CD19FC562J03 OR EQUIV.
C...8	07-10338-0A	CBM 33.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A33K
C...9	07-10340-0A	CBM 22.0NF 400.0 V +-10%	080031	MEPCO C280MCF/A22K
C...10	07-10354-0A	CMD 1.0NF 500.0 V +- 1%	084171	ARCO DM-19-E-D-1000-F-N-U
C...11	07-10301-0A	CBM 680.0NF 63.0 VJ	050587	PLESSEY 161 SER MINIBOX
C...12	07-10103-0A	CMD 250.0PF 500 V +-5%	084171	ELMENCO DM1525J
C...13	07-09564-0A	CCD 5 NF 1 KV M 20%	056289	SPQ TYP 5G1-D50
C...14	07-09571-0A	CCD 50 NF 50 V	071590	CTL TYP CK503
C...16	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...17	07-10053-0A	CET 10.0UF 35.0V M	056289	MALLORY TDC 106M035WLF
C...18	07-09550-0A	CCD 100 NF 12 V M 20%	072982	REFER TO 07-09589-0A
C...20	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...21	07-10447-0A	CEA2200.0UF 16.0 V	050423	CAPAR CRE 2200UF/16V
C...23	07-10009-0A	CCD 2.2NF 500 V DISC	073345	AMPEREX C0238501E222P
C...24	07-10093-0A	CEA 100.0UF 16 V UPFC MNT	000000	STET-TRUSH ERO EK100/16
C...25	07-10092-0A	CEA 470.0UF 35 V	000000	STET-TRUSH ERO EGK470/35
C...27	07-10012-0A	CMD 100.0 PF 500V J DIP MICA	084171	ARCO TYPE RDM15-101J
C...28	07-10183-0A	CET 47.0UF 20.0 VM DIP TAN	056289	SPRAGUE 196D476X0020PE4
C...30	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...32	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...35	07-10496-0A	CCD 100.0NF 50.0 V	000000	CAPAR CCD 1UFYFZ 50V
C...36	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
C...37	07-10562-0A	CCR 0.1 UF 50V .3 SPACE	000000	AVX CERAMICS MD015E104ZAA
CR...1	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...2	05-09468-0A	DGP FD300 150 175M .4	007263	FCH SI D07
CR...3	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...4	05-10110-0A	DZG 1N4571 6.2V 1MA	004713	MOT 1N4571
CR...5	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...10	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...11	05-09469-0A	DGP MDA920A-2 50 1A	004713	MOT BRIDGE REC
CR...12	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...13	05-09477-0A	DZG 1N5231A 5.1 .5W 20M .10%	004713	MOT SI D07
CR...20	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
CR...21	05-10026-0A	DGP 1N4151 75 50M	024446	GE SI D035 4 2
CR...22	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...23	05-10066-0A	DZG 1N 759 12 20M .4	004713	MOT SI
CR...24	05-10071-0A	DGP 1N4934 100 1A	007263	FCH SI 200
CR...25	05-09481-0A	DGP 1N4005 600 1A	004713	MOT SI D041
				GENERAL INSTRUMENT IN4005
L...1	03-10056-0A	CIL .33MH INDUCTOR	083125	NYTRONICS WEE330
Q...1	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
Q...2	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
Q...3	10-10152-0A	TRQ MPSA92 300V 30MA TO92	000000	MOTOROLA
Q...4	10-10130-0A	TRQ E108 N J FET TO-106	017856	SILICONIX E108 A0S=BOHMS
Q...5	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...6	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...7	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...8	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...9	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...10	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...11	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...12	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...13	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...14	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...15	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...16	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...17	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...18	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...19	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...20	10-10080-0A	TRQ 2N4403 PNP	004713	MOTOROLA
Q...22	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
Q...23	10-10134-0A	TRQ MJE370 PNP 1 30 P77-03	004713	MOT 25 40
Q...24	10-09457-0A	TRQ 2N4918 PNP 1 40 P	004713	30 3M 20
Q...26	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...27	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	004713	MOT 1 300M 50
Q...28	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	004713	MOT 1 250M 60
Q...29	10-10187-0A	TRQ MPS-A42 PNP 300V S TO 92	004713	MOTOROLA
QN...1	10-10133-0A	TRQ CA3081 NPN 7 16V S16DIP	086684	RCA O.5W 70
R...1	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	016299	CGW RN60D 5623 F
R...2	09-10116-0A	RVF 100.0 K 250.0MW CERMET	073138	HELIPOT 72PM
R...3	09-10124-0A	RVF 10.0 K 250.0MW K CER	073138	HELIPOT 72PM FLAT MTG
R...4	09-10006-0A	RVC 1.0 K 0.5 W K+-10%	073138	HEL TYP 72PM
R...5	09-10004-0A	RVF 100.0 0.5 W M	073138	HEL TYP 72PM
R...6	12-13124-0A	RFF 8.95K 500.0MW B	016299	CGW RN60E 25PPM
R...8	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM

PARTS LIST, MODEL 3036B-968 MAIN PWB (89-11256-1A) - CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
R. 9	12-13325-0A	RFF 68.1 K 3.0W J+- 5%	014674	CORNING FP2 68.1K +-5%
R. 10	12-13126-0A	RFF 9.0 K 500.0MW B	016299	CGW RN60E 25 PPM
R. 11	12-13125-0A	RFF 1.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 12	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 13	12-13201-0A	RFW 900. 2.0 W 0.05%	091637	DALE RS-2C OR EQUIV
R. 14	12-13202-0A	RFW 90. 2.0 0.05%	091637	DALE RS-2C OR EQUIV
R. 15	12-13203-0A	RFW 9. 2.0 W 0.05%	091637	DALE RS-2C OR EQUIV
R. 16	12-13204-0A	RFW .9 2.0 W 0.05%	091637	DALE RS-2C OR EQUIV
R. 19	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 20	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 21	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 22	12-12300-0A	RFF 1.0 K 250 MW F+-1%	016299	CGW RN55D 1001 F
R. 23	12-12378-0A	RFF 6.49K 250.0MW F+- 1%	016299	CGW RN55D 6491 F
R. 24	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 26	12-12862-0A	RFC 560.0 K 2.0 W 5%	001121	A-B HB
R. 27	12-12873-0A	RFC 560.0 K 900.0MW	001121	A-B TYPE E-B
R. 28	12-08042-0A	RFC 270.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 29	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 30	12-12417-0A	RFF 15.0 K 250.0MW F+- 1%	016299	CGW RN55D 1502 F
R. 31	12-13127-0A	RFF 75.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 32	09-10278-0A	RVF 2.0 K 500. MW 18T VERT		HELIPOT 68WR2K OR EQUIV.
R. 33	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	016299	CGW RN55D 6192 F
R. 34	12-12464-0A	RFF 46.4 K 250.0MW F+- 1%	016299	CGW RN55D 4642 F
R. 35	12-13128-0A	RFF 100.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 36	12-13129-0A	RFF 10.9 K 500.0MW B	016299	CGW RN60E 25PPM
R. 37	09-10107-0A	RVF 200.0 250.0MW K CER	073138	HEL TYPE 72PM-200
R. 38	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 39	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	001121	A-B TYP CB
R. 40	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 41	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 42	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	016299	CGW RN55D 4641 F
R. 43	12-01224-0A	RFC 2.7 250.0MW K+-10%	001121	A-B TYP CB
R. 44	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	016299	CGW RN60D 5623 F
R. 45	09-10134-0A	RVF 50.0 K 0.5 W +-30%	073138	HELIPOT 72PM
R. 46	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 49	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 50	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 51	12-08010-0A	RFC 68.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 52	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 53	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 54	12-01085-0A	RFC 120.0 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 55	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 56	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 58	12-12180-0A	RFF 68.1 250.0MW F+- 1%	016299	RN55D 68R1 F
R. 59	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 60	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 61	12-13157-0A	RFF 90.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 62	12-13130-0A	RFF 10.0 K 500.0MW B	016299	CGW RN60E 25PPM
R. 63	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 64	12-08934-0A	RFC 6.8 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 65	09-10175-1B	RVC 5.0 K+-30% LIN 1/8 SH	090423	CTS XBE 270 50K +- 30%
R. 66	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 70	12-13326-0A	RFC 1.5 500MW J+-5%	01121	AB TYPE EB
R. 71	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 72	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 73	12-08019-0A	RFC 47.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 74	12-08018-0A	RFC 470.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 75	12-01242-0A	RFC 330.0 250.0MW K+-10%	001121	A-B TYP CB
R. 76	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 78	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 79	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	001121	A-B TYP EB
R. 80	12-08046-0A	RFC 10.0 250.0MW J+- 5%	001121	A-B TYP CB
R. 81	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	001121	A-B TYP CB
R. 83	12-13339-0A	RFC 36.0 OHM 2.0W 5%	001121	AB TYPE HB
R. 84	12-13331-0A	RFW .500 .4 WATTS 5%		DALE RS 1/4 .500 OHMS +-5%
R. 94	12-12529-0A	RFF 200.0 K 250 MW F+-1%	016299	CGW RN55D 2003 F
R. 95	12-12224-0A	RFF 178.0 250 MW F+-1%	016299	CGW RN55D 1780 F
R. 96	12-12200-0A	RFF 100.0 250.0MW F+- 1%	016299	CGW RN55D 1000 F
R. 97	12-12200-0A	RFF 100.0 250.0MW F+- 1%	016299	CGW RN55D 1000 F
R. 98	12-12394-0A	RFF 9.53K 250.0MW F+- 1%	016299	CGW RN55D 9531 F
R. 99	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	001121	A-B TYP CB
RN. 1	13-10006-0A	RNF 2.0 K 250.0MW B7RES DIP	080053	BECKMAN 899-3-R 2.0K
RN. 2	13-10044-0A	RNF 100.0 14 1.5W 14DIP 7R	080053	BECKMAN 899-3-R100
S. 0	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 1	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 2	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 3	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 4	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 5	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 6	25-40181-0A	SWC 3036A RANGE SWITCH	050423	TABOR
S. 7	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 8	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 9	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 10	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR
S. 11	25-40182-0A	SWC 3036A FUNCTION SWITCH	050423	TABOR

PARTS LIST, MODEL 3036B-968 MAIN PWB (89-11256-1A) - CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
T...2	20-40062-0A	TRX 3036A DC/DC CONVERTER	050423	TABOR
U...1	24-10212-0A	ICP CA3140E FET OP AM MINDIP	086684	RCA CA3140G FET OPAMP MINIDIP
U...2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	024355	ANALOG DEVICES AD536J
U...5	24-10210-1A	ICP LD120CJ MOD DVM 005%	050423	SILICONIX-ANALOG
U...6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	086664	SILICONIX-ANALOG
U...7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	002413	MOTOROLA DR EGUV
U...8	24-10255-0A	ICP MC14512 MULTIPLEXER	004713	MOTOROLA MC14512
U...9	24-10398-0A	ICP +5 VOLT REFERENCE		PMI REF-02EZ
U...20	24-10153-0A	ICP UA7805 5V REG.	007263	FAIRCHILD UA7805UC

PARTS LIST, MODEL 3036B-968 DISPLAY BOARD ASSEMBLY (89-40310-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
DS...1	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...2	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...3	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...4	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...5	21-10041-0A	IND 0.43 IN. HIEF. RED CC +-1	028480	HP 5082-7656 COMMON CAT.
R...63	12-12164-0A	RFF 46 4 250.OMW F+- 1%	016299	RN55D 46R4 F

PARTS LIST, MODEL 3036B-968 2 VOLT AUTO ZERO ASSEMBLY (89-11255-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...31	07-02236-0A	CMM 200 PF 500 V J 5%	084171	ARCO TYPE CM15-E-201-J
Q...30	10-10005-0A	TRQ MPS6515 NPN 1 25 PTO-92	004713	MOT 350 390M 150
R...90	09-10113-0A	RVF 100.0 K 500.OMW PC TRIM	073138	HEL TYPE 91W
R...91	12-12364-0A	RFF 4.64K 250.OMW F+- 1%	016299	CGW RN55D 4641 F
R...92	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F
R...93	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F

PARTS LIST, MODEL 3036B-968 FRONT PANEL & FRAME ASSEMBLY (89-11257-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...33	07-02543-0A	CCD 1.5NF 3 KV M -20+80%	072982	ERIE 878 HI-K DISC Y5V
C...34	07-02543-0A	CCD 1.5NF 3 KV M -20+80%	072982	ERIE 878 HI-K DISC Y5V
CB...1	19-10060-0A	CBK 2.0A CIRCUIT BREAKER		LITTLEFUSE 815 003
CR...14	05-08058-0A	DGP IN4006 400 1A	015238	ITT SI D046
CR...15	05-08058-0A	DGP IN4006 400 1A	015238	ITT SI D046
F...1	19-02801-0A	FUS 1/4 A SLO BLO	075915	LTF 3AG-1/4 DR EQUIV.
J...1	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...2	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...4	31-10133-0A	BPS 10MM BLACK	050423	BLI ELMA INTERLK 024-2020
J...5	31-03962-0A	BPS BINDING	050423	
J...10	31-10001-0A	CON 3 PIN MALE REC	029587	AMPH MS-3102A-10SL-3P
S...12	25-10151-1C	SWC 9648M LINE VOLT 6P4POS	050423	
T...1	20-10054-1R	TRX 3038A POWER	050423	BLI

PARTS LIST, MODEL 3036B-968 BATTERY REPLACEMENT KIT ASSEMBLY (89-11262-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
BT...1-4	85-10086-0A	BAT NICAD 4AH SDR TAB/SLEEVE	000000	GOULD 4.0 SCL/GE GCW3.5ST

PARTS LIST, MODEL 3036B-968 PARTS KIT ASSEMBLY (89-11260-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
RN...3	13-10117-1B	RNF 3036 ATTENUATOR NETWORK	050423	CADDOCK SPECIAL

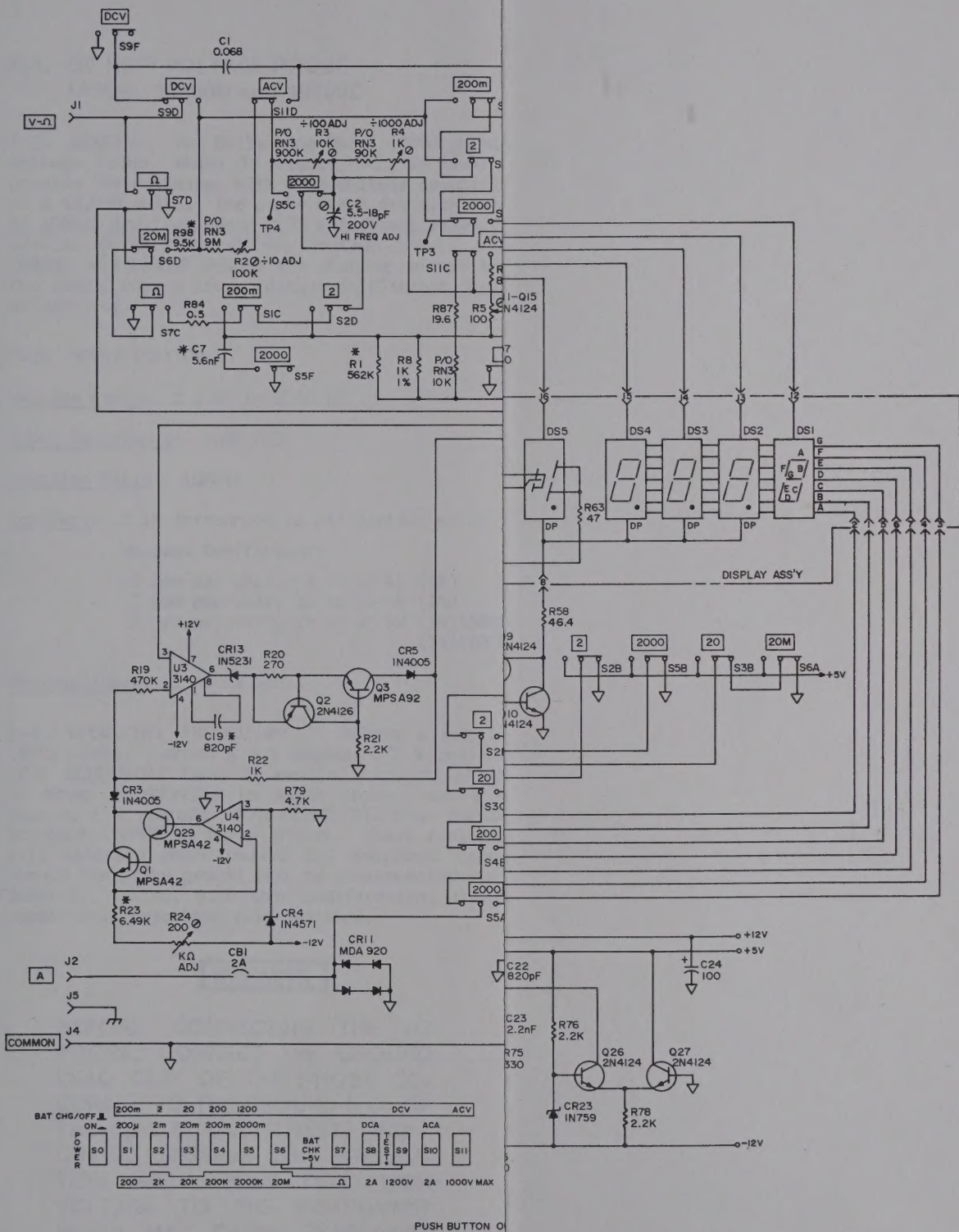


Figure 6-4. Model 3036B-968, 4 1/2 Digit DMM, Schematic Diagram

PARTS LIST, MODEL 3036B-968 MAIN PWB (89-11256-1A) - CONT'D

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
T...2	20-40062-0A	TRX 3036A DC/DC CONVERTER	050423	TABOR
U...1	24-10212-0A	ICP CA3140E FET OP AM MINDIP	086684	RCA CA3140G FET OPAMP MINIDIP
U...2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	024355	ANALOG DEVICES AD536J
U...5	24-10210-1A	ICP LD120CJ MOD DVM 005%	050423	SILICONIX-ANALOG
U...6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	086664	SILICONIX-ANALOG
U...7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	002413	MOTOROLA DR EQUIV
U...8	24-10255-0A	ICP MC14512 MULTIPLEXER	004713	MOTOROLA MC14512
U...9	24-10398-0A	ICP +5 VOLT REFERENCE		PMI REF-02EZ
U...20	24-10153-0A	ICP UA7805 5V REG.	007263	FAIRCHILD UA7805UC

PARTS LIST, MODEL 3036B-968 DISPLAY BOARD ASSEMBLY (89-40310-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
DS...1	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...2	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...3	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...4	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.00	028480	HP 5082-7650
DS...5	21-10041-0A	IND 0.43 IN. HIEF. RED CC +-1	028480	HP 5082-7656 COMMON CAT.
R...63	12-12164-0A	RFF 46 4 250.OMW F+- 1%	016299	RN55D 46R4 F

PARTS LIST, MODEL 3036B-968 2 VOLT AUTO ZERO ASSEMBLY (89-11255-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...31	07-02236-0A	CMM 200 PF 500 V J 5%	084171	ARCO TYPE CM15-E-201-J
Q...30	10-10005-0A	TRQ MPS6515 NPN 1 25 PT0-92	004713	MOT 350 390M 150
R...90	09-10113-0A	RVF 100.0 K 500.OMW PC TRIM	073138	HEL TYPE 91W
R...91	12-12364-0A	RFF 4.64K 250.OMW F+- 1%	016299	CGW RN55D 4641 F
R...92	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F
R...93	12-12400-0A	RFF 10.0 K 250.OMW F+- 1%	016299	CGW RN55D 1002 F

PARTS LIST, MODEL 3036B-968 FRONT PANEL & FRAME ASSEMBLY (89-11257-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
C...33	07-02543-0A	CCD 1.5NF 3 KV M -20+80%	072982	ERIE 878 H1-K DISC Y5V
C...34	07-02543-0A	CCD 1.5NF 3 KV M -20+80%	072982	ERIE 878 H1-K DISC Y5V
CB...1	19-10060-0A	CBK 2.0A CIRCUIT BREAKER		LITTLEFUSE 815 003
CR...14	05-08058-0A	DGP IN4006 400 1A	015238	ITT SI D046
CR...15	05-08058-0A	DGP IN4006 400 1A	015238	ITT SI D046
F...1	19-02801-0A	FUS 1/4 A SLD BLD	075915	LTF 3AG-1/4 DR EQUIV.
J...1	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...2	31-10132-0A	BPS 10MM GREY	050423	BLI ELMA INTERLK 024-2010
J...4	31-10133-0A	BPS 10MM BLACK	050423	BLI ELMA INTERLK 024-2020
J...5	31-03962-0A	BPS BINDING	050423	
J...10	31-10001-0A	CON 3 PIN MALE REC	029587	AMPH MS-3102A-10SL-3P
S...12	25-10151-1C	SWC 9648M LINE VOLT 6P4POS	050423	
T...1	20-10054-1R	TRX 3038A POWER	050423	BLI

PARTS LIST, MODEL 3036B-968 BATTERY REPLACEMENT KIT ASSEMBLY (89-11262-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
BT...1-4	85-10086-0A	BAT NICAD 4AH SDR TAB/SLEEVE	000000	GOULD 4.0 SCL/GE GCW3.5ST

PARTS LIST, MODEL 3036B-968 PARTS KIT ASSEMBLY (89-11260-1A)

SCHEMATIC REF.	BALLANTINE PART NO.	DESCRIPTION	MFR. CODE	MFR. PART NUMBER
RN...3	13-10117-1B	RNF 3036 ATTENUATOR NETWORK	050423	CADDOCK SPECIAL

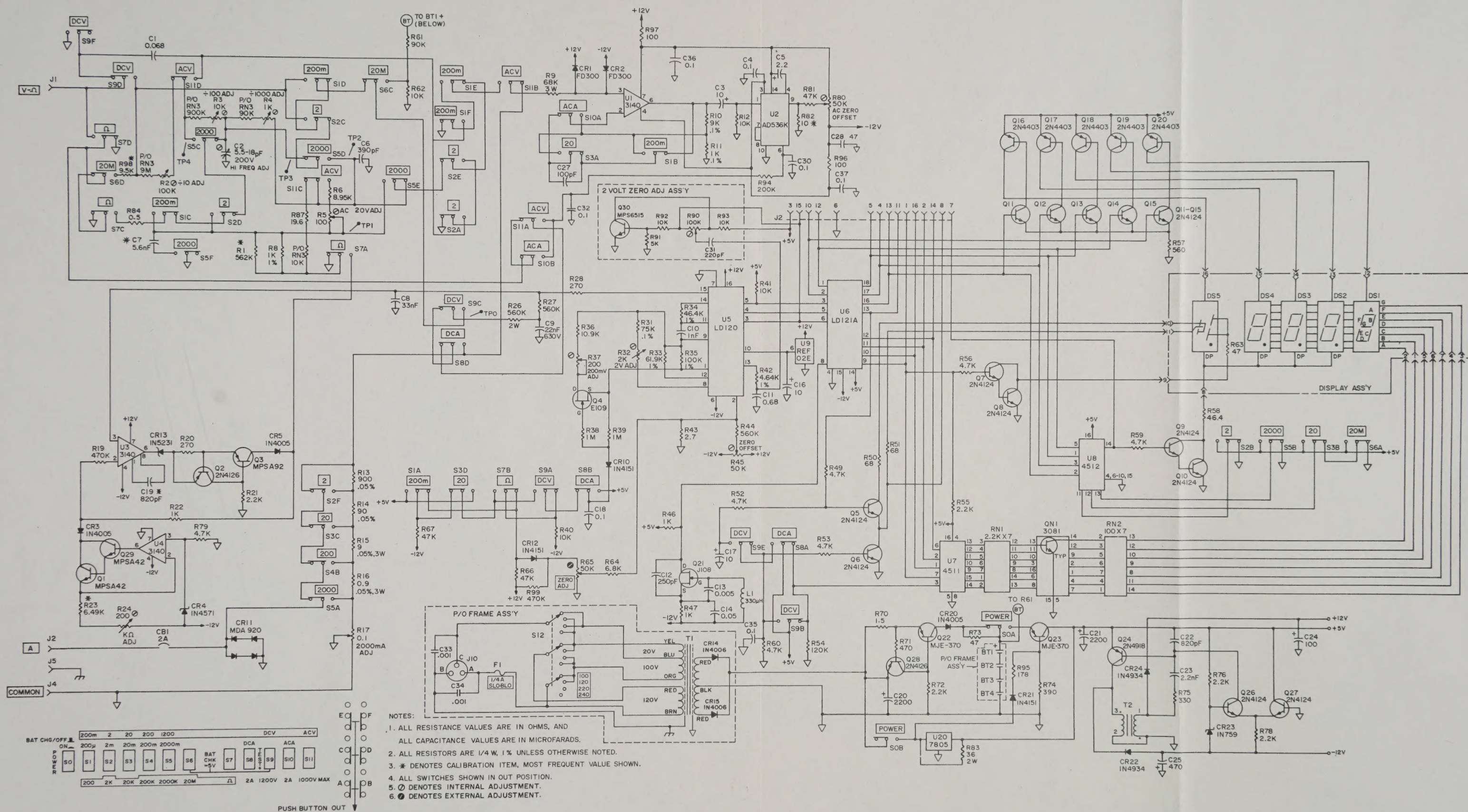


Figure 6-4. Model 3036B-968, 4 1/2 Digit DMM, Schematic Diagram

SECTION 7

ACCESSORIES

7-1. DC HIGH VOLTAGE PROBE MODEL 10800B and 10800C

7-2. GENERAL. The Ballantine Model 10800 DC High Voltage Probe, shown in Figure 7-1, is used to provide the voltmeter with a dc voltage capability to $\pm 40,000$ volts. The probe has a division ratio of 1000:1 and features a $\pm 5\%$ adjustment range for precise calibration at any voltage input. The 10800B and 10800C probes are similar except that the 10800C uses a lower voltage coefficient divider resistor.

7-3. SPECIFICATIONS

Voltage Range: ± 1 kV to ± 40 kV

Input Resistance: 1000 M Ω

Division Ratio: 1000:1

Accuracy: $\pm 1\%$ referenced to calibration point

Voltage Coefficient:

- 2 ppm per volt, 1 to 10 kV (2%)
- 3 ppm per volt, 10 to 20 kV (3%)
- 5 ppm per volt, 20 to 40 kV (5%) 10800B
- (3%) 10800C

Maximum Input: ± 40 kV peak

7-4. OPERATING PRECAUTIONS. Before using the 10800 probe, connect a 3.3 Megohm, 1/2 W resistor (P/N 12129340A) from the neutral terminal of the ac power receptacle, to earth ground, and a 47 Megohm, 1 W resistor (P/N 12129350A) from the instrument COMMON to earth ground. These resistors will minimize shock hazard and equipment damage should the probe ground lead be disconnected accidentally. Also, with this modification, the dc common mode rejection will decrease.

WARNING

BEFORE CONNECTING THE HV PROBE, CONNECT THE GROUND LEAD CLIP OF THE PROBE SECURELY TO THE GROUND (LO) OF THE CIRCUIT UNDER TEST. FAILURE TO OBSERVE THIS PRECAUTION WILL APPLY FULL HIGH VOLTAGE TO THE INSTRUMENT WHICH MAY CAUSE PERSONNEL SHOCK AND INSTRUMENT DAMAGE. THE GROUND-LEAD VOLT-

AGE MUST NOT EXCEED THE PEAK VOLTAGE RATING OF THE INSTRUMENT BETWEEN COMMON AND POWERLINE EARTH GROUND. HANDLE THE PROBE ONLY AT ITS BLACK HANDLE AND AVOID CONTACT WITH THE FLASH GUARD AND TIP AREA.

7-5. OPERATING PROCEDURE

- a. Set the voltmeter for POWER ON and DC Volts.
- b. Select the voltmeter 2 V range for operation to ± 2 kV, the 20 range for operation to ± 20 kV, or the 200 range for operation up to ± 40 kV. The display will read directly in kV.
- c. Plug the termination of the 10800B probe into the V- Ω and COMMON connectors of the instrument, making sure that the red-marked banana plug of the termination mates with the V- Ω connector of the instrument.
- d. Connect the ground-lead clip of the probe to the ground (LO) of the circuit under test.
- e. Connect the probe tip to the circuit under test.
- f. Turn the equipment on to apply the signal and read the instrument display.

7-6. CALIBRATION

- a. Set the voltmeter for POWER ON, DC Volts, and 2 Volt Range.
- b. Plug the 10800B probe termination into the V- Ω and COMMON connectors of the instrument, making sure that the red-marked banana plug of the termination mates with the V- Ω connector of the instrument.
- c. Remove the four screws from the cover of the probe termination box and remove the cover to gain access to the potentiometer, R2.
- d. Connect the ground-lead clip of the probe to the ground of a Fluke Model 332B DC Voltage Standard.
- e. Connect the probe tip the HI output of the Model 332B.
- f. Apply +1000.00 volts.

g. Use an insulated screwdriver and adjust R2 for a voltmeter display of .999 to 1.001.

h. Replace the cover of the probe termination box and secure it with the four screws.

NOTE

Calibration may be performed at any voltage to 40 kV using other voltage standards and voltmeter ranges.

7-7. SCHEMATIC DIAGRAM. A schematic diagram of the Model 10800 DC High Voltage Probe is shown in Figure 7-2.

TABLE 7-1. PARTS LIST, DC HIGH VOLTAGE PROBE MODEL 10800

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 1	09101640A	RVF 500.0 K 250 MW K CERMET	73138	HELIPOT 72XW VERT MT
R 2	12125920A	RFF 909.0 K 500 MW F+-1%	16299	CGW RN60D9093F
---	79071410A	CBL 20-1 CONDUCTOR PLASTIC	92194	ALPHA NO. 1706
---	79045231A	WIRE, TEST LEAD, BLK	50423	BLI
---	49044360A	ALLIGATOR CLIP	76545	MUELLER NO. 60

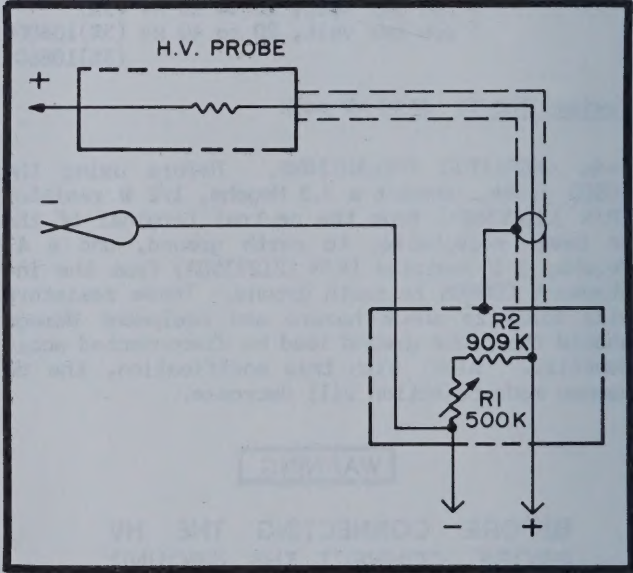
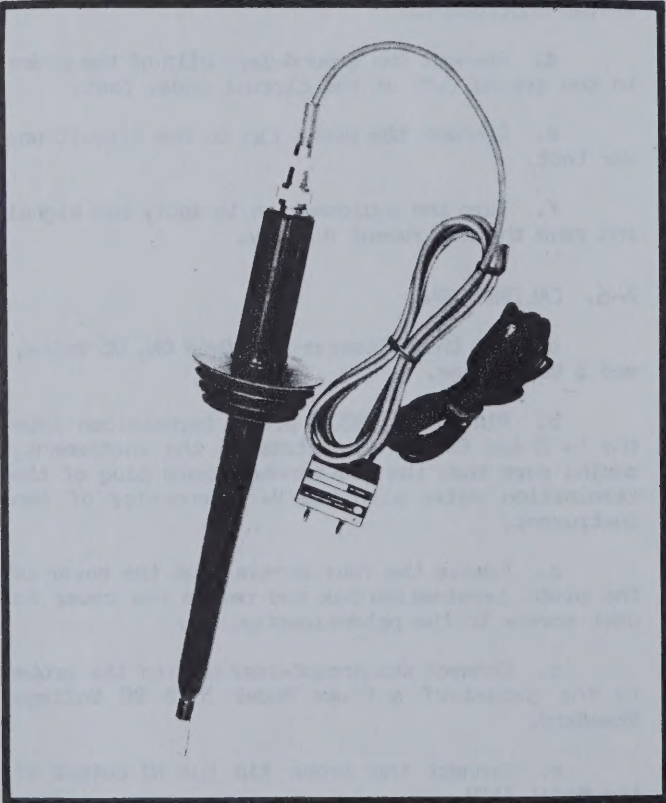


Figure 7-2. Model 10800 DC High Voltage Probe, Schematic Diagram

Figure 7-1. Model 10800 DC High Voltage Probe

7-8. AC HIGH VOLTAGE PROBE MODEL 1301B

7-9. GENERAL. The Ballantine Model 1301B AC High Voltage Probe, shown in Figure 7-3, is used to extend the ac rms voltage range of the instrument to 10 kV rms (14 kV peak). The probe has a capacitive division ratio of 10,000:1 (80 dB) and features a $\pm 5\%$ adjustment range for precise calibration at any voltage amplitude and frequency input. The 1301B is not a detector probe and, therefore, retains the rms response of the voltmeter. Although the probe is usable beyond 6 MHz, its usefulness is limited to the specifications of the voltmeter.

7-10. SPECIFICATIONS

Voltage Range: <1 kV to 10 kV rms (14 kV peak)

Input Impedance: <10 pF in parallel with 1000 M Ω

Load Impedance: <100 pF in parallel with >1 M Ω

Division Ratio: 10,000:1 (80 dB)

Maximum Input: 10 kV rms sinusoidal; 14 kV peak

Accuracy: Adjustable $\pm 1\%$ to any reference condition within the specification.

All accuracies are additive to the accuracies of the voltmeter.

45 Hz to 10 kHz $\pm 1\%$

40 Hz to 110 kHz $\pm 2\%$

110 kHz to 1 MHz $\pm 5\%$

1 MHz to 6 MHz $\pm 10\%$

7-11. OPERATING PRECAUTIONS. Before using the 1301B probe, connect a 3.3 Megohm, 1/2 W resistor (P/N 12129340A) from the neutral terminal of the ac power receptacle, to earth ground, and a 47 Megohm, 1 W resistor (P/N 12129350A) from the instrument COMMON to earth ground. These resistors will minimize shock hazard and equipment damage should the probe ground lead be disconnected accidentally. Also, with this modification, the common mode rejection will decrease.

WARNING

BEFORE CONNECTING THE HV PROBE, CONNECT THE GROUND-LEAD CLIP OF THE PROBE SECURELY TO THE GROUND (LO) OF THE CIRCUIT UNDER TEST. FAILURE TO OBSERVE THIS PRECAUTION WILL APPLY FULL HIGH VOLTAGE TO THE INSTRUMENT WHICH MAY DAMAGE THE EQUIPMENT AND PRESENT A SHOCK HAZARD. GROUND-LEAD SHOULD BE CONNECTED TO POWER LINE EARTH GROUND. GRASP THE PROBE ONLY AT ITS HANDLE AND AVOID CONTACT WITH THE FLASH

GUARD AND TIP AREA. CONNECT PROBE WITH POWER OFF AND AVOID HAND HELD PROBE OPERATION.

WARNING

USE OF AN AC PROBE TO MEASURE RF VOLTAGE IN HIGH POWER AND/OR TUNED CIRCUITS MAY CAUSE HAZARDOUS CONDITIONS DUE TO RESONANCES OR LEAKAGE PATHS. USE EXTREME CAUTION AND UNDERSTAND TEST CONDITIONS OF UNIT UNDER TEST TO AVOID SHOCK HAZARD. USE HIGH VOLTAGE SAFETY GLOVES AND CONNECT PROBE TO UNIT UNDER TEST WITH POWER OFF. AVOID HAND HELD PROBE USE ON HIGH POWER, LOW IMPEDANCE OR ANY CIRCUITS WHICH HAVE VOLTAGES AND CURRENTS THAT MAY PRODUCE SHOCK HAZARD.

7-12. OPERATING PROCEDURE

- Set the voltmeter to POWER ON and AC Volts.
- Select the 200 mV range for operation to 2 kV and the 2 Volt range for operation up to 10 kV. The display will read directly in kV.
- Plug the termination of the 1301B probe into the V- Ω and COMMON connectors of the instrument, making sure that the red-marked banana plug of the termination mates with the V- Ω connector of the instrument.
- Connect the ground-lead clip of the probe to the ground (LO) of the circuit under test.
- Connect the probe tip to the circuit under test.
- Turn the equipment on to apply the signal and read the instrument display.

7-13. CALIBRATION

- Set the voltmeter to POWER ON, AC Volts, and 200 mV range.
- Plug the 1301B probe termination into the V- Ω and COMMON connectors of the instrument, making sure that the red-marked banana plug of the termination mates with the V- Ω connector of the instrument.
- Unscrew the tip of the 1301B probe to provide access to the calibration adjustment screw.

d. Connect the ground-lead clip of the probe to the ground of an ac voltage calibrator.

e. Connect the probe tip to the ac calibrator and apply 1 kV at 1 kHz.

f. Adjust the probe calibration screw with an insulated screwdriver until the DMM display reads .997 to 1.003.

g. Re-install the probe tip and recheck the calibration.

7-14. SCHEMATIC DIAGRAM. A schematic diagram of the Model 1301B AC High Voltage Probe is shown in Figure 7-4.

TABLE 7-2. PARTS LIST, AC HIGH VOLTAGE PROBE MODEL 1301B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 2	07081060A	CSM 27 NF 100 V J+-5%	92741	GOODALL TYPE 820UB
R 1	12012240A	RFC 2.7 250 MW K+-10%	01121	A-B TYPE CB
R 2	12012240A	RFC 2.7 250 MW K+-10%	01121	A-B TYPE CB
R 3	12012250A	RFC 22.0 M 250 MW K+-10%	01121	A-B TYPE CB
R 4	12012250A	RFC 22.0 M 250 MW K+-10%	01121	A-B TYPE CB
R 5	12012250A	RFC 22.0 M 250 MW K+-10%	01121	A-B TYPE CB
R 7	12011230A	RFC 2.2M 500.0MW J+-5%	1121	A-B TYPE EB
---	89054691A	GROUND LEAD ASSY	50423	
---	80070000A	SILICONE SEALING COMPND	71984	DOW CORNING NO. 5

WARNING

NEVER OPERATE THIS PROBE WITHOUT A SECURE EARTH GROUND CONNECTION, AND USE HIGH VOLTAGE SAFETY GLOVES TO AVOID SHOCK HAZARD.

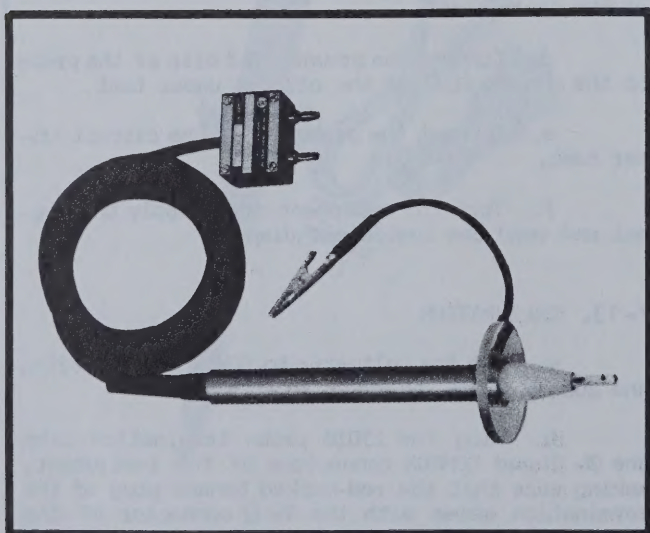


Figure 7-3. Model 1301B AC High Voltage Probe

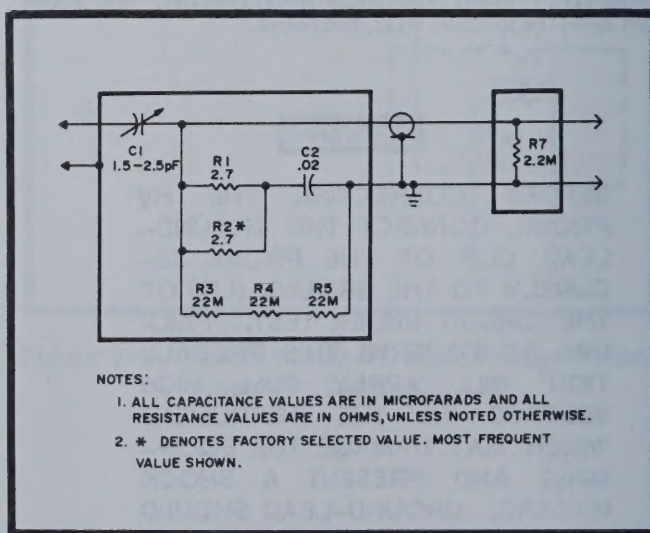


Figure 7-4. Model 1301B AC High Voltage Probe, Schematic Diagram

7-15. RF DETECTOR PROBE MODEL 10850B

7-16. GENERAL. The Ballantine Model 10850B RF Detector Probe, shown in Figure 7-5, is a peak detector probe calibrated in rms voltage. It uses semiconductor diodes and provides measurement capability beyond 700 MHz for sinusoidal signals. The maximum signal is 30 volts rms and a blocking capacitor will hold off dc to a maximum of ± 200 V.

7-17. SPECIFICATIONS

Frequency Range: < 50 kHz to >700 MHz

AC to DC Transfer Accuracy (20°C to 30°C):

May be adjusted to within $\pm 1\%$ at any one frequency range from 100 kHz to 100 MHz at a level of 1 volt rms input.

Frequency Response:

100 kHz to 1 MHz ± 1 dB
1 MHz to 100 MHz ± 0.5 dB
100 MHz to 270 MHz ± 1 dB
270 MHz to 470 MHz ± 3 dB

Linearity:

1 dB from 0.75 volts to 5 volts typically within ± 3 dB over the entire dynamic operating range.

Maximum Input Voltage:

RF 30 volts RMS sinusoidal
DC ± 200 volts

Operating Voltage Range:

Usable from 10 mV to 30 Vrms sinusoidal.
Specified range from 250 mV to 25 V rms.

Input Capacity:

≈ 4.5 pF

Output:

DC Voltage proportional to the input rms of a sine wave when terminated by a 10 M Ω load.

Detector Response:

Peak responding and calibrated in rms of a sine wave.

Cable Length:

1.5 meters (5 feet); terminated in dual banana plugs spaced 0.75 inches apart.

Accessories:

Ground lead with alligator clip, BNC adapter sleeve, retractile hook tip.

a retractile hook-tip is provided for convenience. For optimum accuracy above 10 MHz, the coaxial BNC adapter sleeve should be used. No ground lead is required when using the BNC adapter. The adapter is slipped onto the probe barrel and fits into any BNC female connector. The probe should always be used in a terminated system. The Ballantine Model 12630A 50-ohm BNC feed-thru termination is recommended.

Maximum input voltage to the probe is 30 V rms or ± 200 V dc. The 30 volt rms ac level is additive and must be combined with the dc limit so as not to exceed ± 200 volts peak.

CAUTION

DC input level changes greater than ± 200 volts will damage the probe.

The Ballantine Model 10851A RF High Voltage Probe Kit is available for measurements to 500 V rms and 1 GHz.

Take care to avoid ground current and common mode voltage measurement errors. Use battery off-line operation and/or check the effects of earth ground the COMMON connector of the voltmeter.

7-19. VOLTAGE MEASUREMENT OF CW OR FM SINE WAVE SIGNALS

a. Connect the 10850B probe termination to the V- Ω and COMMON inputs of the voltmeter. Make sure the red-marked (HI) banana plug is connected to the V- Ω connector.

b. Attach the required probe tip, BNC adapter, and termination. Connect the probe to the circuit point to be measured.

c. Set the voltmeter to POWER ON and DC Volts.

d. Select the desired voltage range: 200 m, 2, or 20.

e. Note the display, which reads in volts rms. (Disregard the polarity sign).

7-20. DEMODULATION MEASUREMENT OF AM SIGNAL ON HIGH-FREQUENCY CARRIER

a. Connect the 10850B probe termination to the V- Ω and COMMON inputs of the voltmeter. Make sure the red-marked (HI) banana plug is connected to the V- Ω connector.

b. Attach the required probe tip, BNC adapter, and termination. Connect the probe to the circuit point to be measured.

c. Set the voltmeter to POWER ON, and AC Volts.

d. Select the desired range: 200 m, 2, or 20.

7-18. OPERATION. The probe is supplied with an integral straight tip. It may be used with its ground lead connection to 100 MHz. Additionally,

e. Make sure the AM frequency is within the range of 50 Hz to 20 kHz, that the amplitude is stable and that the carrier frequency is between 100 kHz and 700 MHz.

f. The digital display will show the rms voltage of the carrier.

7-21. CALIBRATION. The Model 10850B RF Probe is normally calibrated at 1 MHz. An ac voltage calibrator, such as the Boonton Electronics Model 26A, may be used to set the calibration with the trim potentiometer provided in the probe termination. No high frequency calibration is required. Proceed as follows:

a. Connect the 10850B probe to the V- Ω and COMMON inputs of the instrument.

b. Note the potentiometer adjustment in the banana termination or if your probe has a metal termination box, remove the four screws and cover from the probe termination housing.

c. Connect the 10850B probe to an ac voltage calibrator, such as the Boonton Electronics Model 26A. Set the Calibrator output to 1 volt rms at 1 MHz.

d. Push the voltmeter switches to POWER ON, DC Volts, and 2 Volt range.

e. Adjust the trim potentiometer with an insulated screwdriver until the instrument display reads .998 to 1.002.

f. If desired, check the probe at 250 mV rms, 10 V rms, and 25 V rms inputs to obtain an indication of linearity which must provide an output of 0.75 to 1.3 with the probe calibrated at 1 volt.

g. When applicable, replace the probe termination cover and the four screws.

7-22. HIGH-FREQUENCY CALIBRATION. Should high frequency calibration be required to check frequency response of the probe, very specific test equipment is required to generate a high frequency voltage source directly at the input tip of the probe without intervening lead lengths, connector or coaxial cables which cause mismatch errors. The source must be low in impedance to minimize the capacitive loading by the probe. A Model 440 micropotentiometer with 22 ohm coaxial resistor is required test equipment. Although a 1 volt rms test level is recommended, a 0.5 volt level is acceptable when the rf power capability is not available to drive the 22 ohm coaxial micropot resistor to 1 volt levels. Use a Micropotentiometer with a 50 mA thermal element for 0.5 volt amplitudes.

a. **TEST SET-UP.** Set-up the micropot to be driven from a 1 MHz, 10 MHz, 100 MHz, 270 MHz and 470 MHz sources having low harmonic distortion levels. Fit the coaxial probe tip BNC adapter sleeve to the RF Detector Probe and insert it fully into the exposed "N" connector of the 22 ohm coaxial micropot resistor. Use a Ballantine 1610A

Control unit as a Lindeck potentiometer control for the micropotentiometer thermal element output or use a dc digital voltmeter with 10 microvolt resolution to monitor the thermal element output voltage. Connect a dc voltmeter such as the Ballantine 3028B DMM set to the 2 volt dc range to the output of the RF Detector Probe under test.

b. TEST PROCEDURE

1. Apply 1 MHz to the micropot and carefully increase the ac signal until the probe readout dc digital meter indicates $1.000 \pm .008$ V (or $0.500 \pm .005$ when using half volt levels).

2. Note the output of the Model 440 micropotentiometer thermal element voltage or null the Lindeck potentiometer when using the Model 1610A Control Unit.

NOTE

The micropotentiometer readings must be corrected for the micropot NBS traceable frequency response AND a transmission line length of 13 mm with a capacitive load of 4.5 pF at each frequency tested.

3. Change the input frequency to 10 MHz and reset the ac input level to provide the same micropotentiometer thermal element output noted in step b and corrected as indicated in the above note.

4. The probe readout DVM should read within the corrected limits of .950 and 1.050 (0.475 and 0.525).

5. Repeat step 3 at 100 MHz input. The probe readout DMM should read within the corrected limits of 0.940 and 1.060 (0.470 and 0.530).

6. Repeat step 3 with 270 MHz input. The probe readout DMM should read within the corrected limits of 0.890 and 1.110 (0.445 and 0.555).

7. Repeat step 3 with 470 MHz input. The probe readout DMM should read within the corrected limits of 0.700 and 1.300 (0.350 and 0.650).

NOTE

The above test procedure and limits require the test equipment specified. Use of any other test set-up and equipment will not provide verification of probe performance within the stated limits.

7-23. SCHEMATIC DIAGRAM. A schematic diagram of the Model 10850B RF Detector Probe is shown in Figure 7-6.

7-24. PARTS LIST. The probe is sealed and the entire probe must be replaced when the demodulator probe head is faulty. Replaceable parts are listed in Table 7-3. Some probes feature a modular construction. For these probes the cable may

be replaced by simply holding the probe tip or termination and unscrewing the plastic retainer sleeve. The cable may then be separated from the tip or termination by a gentle pull. For installation of a new cable reverse this procedure.

TABLE 7-3a. PARTS LIST, RF DETECTOR PROBE MODEL 10850B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 1	07025920A	CCD 1.0 NF 1.0 KV K+-10%	84171	ARCO TYPE CCD-102
R 1	12125920A	RFF 909.0K 500.0MW F+-1%	16299	CGW RN60D 9093 F
R 2	09102300A	RVF 250.0K 250 0MW K CER.	0	HELIPOT 72XW VERT MT
---	85100580A	PROBE AND CABLE ASSEMBLY	50423	BLI

TABLE 7-3b. PARTS LIST, RF DETECTOR MODULAR PROBE MODEL 10850B/M

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
-----	85101581	PRB CABLE ASY.2MTR.FOR 10611	50423	BLI
-----	85101701	PRB 10850B/M DETECT. BARRELL	50423	BLI
-----	85101711	TRM 10850B/M ADJ. DUAL BAN.	50423	BLI

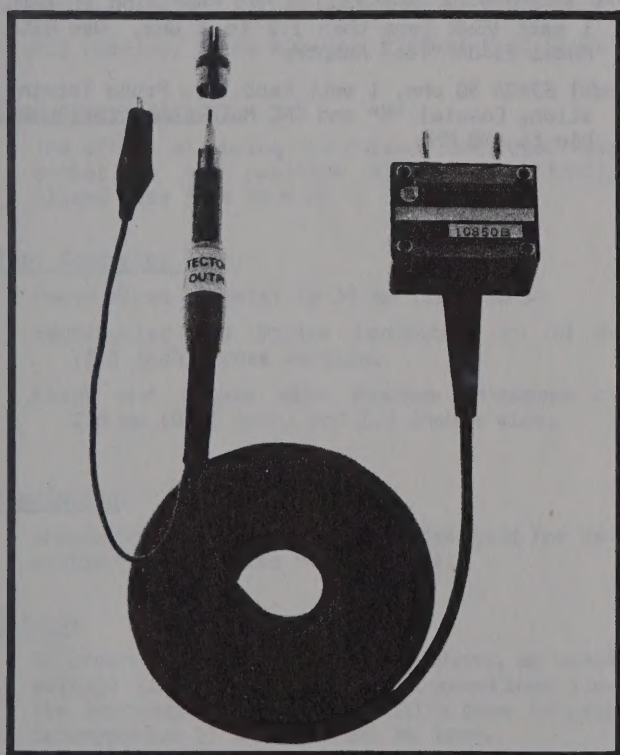


Figure 7-5. Model 10850B RF Detector Probe

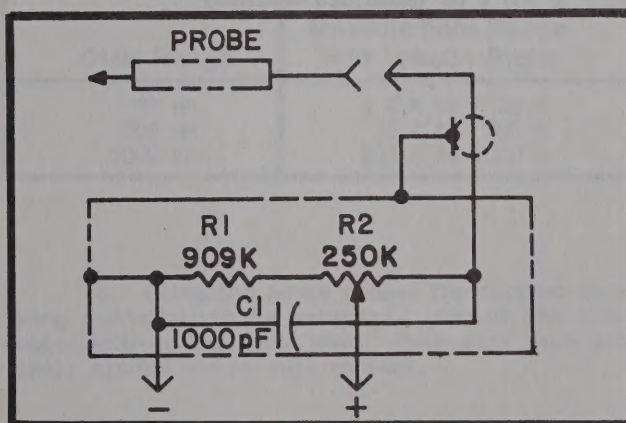


Figure 7-6. Model 10850B RF Detector Probe, Schematic Diagram

7-25. HIGH VOLTAGE RF DETECTOR PROBE, MODEL 10851A

7-26. GENERAL. The Model 10851A RF Probe is a sturdy probe, capable of operation to beyond 1200 MHz and at voltages to 30 volts rms. A capacitive divider is supplied to extend the input voltage to 500 V rms. The probe body is sized for 50 ohm Type N Connector accessories and accomodates various accessories including a 100:1 Capacitive Divider, and an optional non-loading 50 ohm Tee Adapter.

7-27. SPECIFICATIONS

Usable Frequency Range: < 20 kHz to >1200 MHz

AC to DC Transfer Accuracy:

(Input from 50 ohm coaxial system; Output into 10 megohms; + 20°C to + 30°C).

± .5 dB 500 kHz to 200 MHz

± 1.0 dB 200 MHz to 500 MHz

± 1.5 dB 500 MHz to 1000 MHz

Specification applicable with Model 5340A Tee Adapter for measurements above 100 MHz.

Operating Voltage Range: Sinusodial inputs

220 mV to 30 V rms Probe alone

22 V to 500 V rms Probe with 1340A divider

Maximum Input Voltage:

(limit of 5×10^9 rms volt hertz):

Probe - 43 V peak; ± 400 DC

Probe with Model 1340A Divider: 700 V AC peak;
± 500 V DC (absolute maximum)

Input Impedance:

Probe - ≈ 3 pF shunted by ≈ 100 K

Probe with 1340A Divider - ≈ 4.5 pF shunted by
>10 Megohm

Response:

Peak detector calibrated in rms of a sine wave from 250 mV to 25 V for the probe and 25 V to 500 V for the probe with Model 1340A divider.

Calibration:

Probe may be calibrated with ± 1% of nominal from 1 MHz to 100 MHz sinusoidal input from 50 ohms. Factory calibration is performed at 1 volt rms and 1 MHz. Model 1340A Capacitive Divider is factory calibrated for division ratio of ± 1% at 1 MHz.

Cable Length: 1.5 meters (5 feet)

ACCESSORIES SUPPLIED:

Model 10851A Probe Assembly

Model 1340A 100:1 Capacitive Voltage Divider

Model 4340A Adapter, tip

OPTIONAL ACCESSORIES:

Model 2340A Adapter, Coaxial "N" and BNC Male Connector

Model 5340A Adapter, non-loading "Tee" for 50 ohm lines; mates with Type "N" Connectors

P/N 31-10189-0A Termination "N" Precision 50 ohm, 1 watt VSWR less than 1.2 to 1 GHz. Use with Model 5340A "Tee" Adapter

Model 6340A 50 ohm, 1 watt Feed-Thru Probe Termination, Coaxial "N" and BNC Male Connector, usable to 600 MHz

7-28. CURRENT PROBE, AC, CLAMP-ON MODEL 10860A

7-29. GENERAL. The Ballantine Model 10860A AC Current Probe extends the ac current measuring capability of Digital Multimeters. The probe covers a current range from 2 to 1000 amperes. Frequency coverage is from less than 50 Hz to greater than 400 Hz. Nominal accuracy is $\pm 3\%$ at 60 Hz. A voltage limiter is incorporated in the current probe to protect the operator against electric shock and limits the output voltage to 2.4 volts peak to peak irrespective of the test current magnitude or DMM current range selected. The clamp-on feature allows ac currents to be measured without breaking into the leads of the circuit under test. The effect of moving the current conductor from the center to any position within the core jaws is less than 3%.

7-30. SPECIFICATIONS

Frequency Range: < 50 Hz to >400 Hz.

Current Range:

2 Amperes to 1000 Amperes Sinusoidal Current

Accuracy:

Entire range $\pm 3\%$ of Full Scale used. Calibrated at 60 Hz, with current conductor centered.

Frequency Response:

- >25 Amperes, 50 to 400 Hz: $\pm 3\%$ of Full Scale
- >15 Amperes, 50 to 400 Hz: $\pm 4\%$ of Full Scale
- >10 Amperes, 50 to 400 Hz: $\pm 10\%$ of Full Scale

Conductor Position:

The effect of moving the current conductor from center to any position within the tightly closed core jaws is < 3%.

Test Conductor Size:

- Round Wires Diameter to 38 mm (1.5 inch).
- Rectangular and Square Conductors to 38 mm (1.5 inch) cross section.
- Foils and Sheets with maximum thickness of 2.8 mm (0.11 inch) and 1.8 inches wide.

Insulation:

Insulation of probe housing is designed for operation to 650 volts rms at 60 Hz.

Safety:

To protect the operator against shock, an over-voltage limiter on the output connections limits terminal voltage to 2.4 volts peak to peak irrespective of test current or load.

Connector:

Dual banana plugs spaced 1.9 mm (0.75 inch).

7-31. OPERATING INSTRUCTIONS

WARNING

The clamp-on probe housing is made of high quality insulation and designed to provide long service under stress of frequency usage. EXERCISE EXTREME CARE WHEN MEASURING HIGH CURRENTS AND WHEN CLAMPING ON WIRES OR APPLIANCES CARRYING HIGH POWER LINE VOLTAGES.

NEVER USE THE PROBE WHEN THE INSULATING MATERIAL OR THE HOUSING IS DAMAGED OR WHEN THE MAGNETIC CORE MAY COME IN CONTACT WITH HIGH VOLTAGES.

7-32. Use the following procedure for operating the Model 10860A AC Clamp-On Current Probe.

- a. Plug the 10860A dual banana termination into the A and COMMON terminals of the voltmeter.
- b. Select the current function.
- c. Select ac operation. The 10860A can be used on sinusoidal and distorted ac signals so that the rms responding detectors will provide improved accuracy of measurement.
- d. Select the DMM Current Range as indicated below:

DMM Range	Measurement Range With 10860A Probe
20 mA	2 A to 20 A
200 mA	20 A to 200 A
2000 mA	200 A to 1000 A

- e. Clamp the probe around the current carrying conductor to be measured. Center the conductor within the core jaws. Make sure jaws are firmly closed and in full contact.

NOTE

Clamping the probe around the current carrying conductor at a time produces a reading on the voltmeter which is the vector sum of the currents in each of the conductors.

- f. Read the voltmeter. It is indicating the measured current in Amperes.

7-33. MAINTENANCE. The Model 10860A is a rugged instrument designed for long life in every day service. The high quality plastic housing must be checked for damage to avoid electrical contact with the magnetic jaws. Avoid solvents or vapors which may attack the plastic. Clean with water and mild detergents.

7-34. Keep the magnetic surfaces of the jaw mating surfaces clean and free from dust, wire insulation or other dirt. The clamp-on probe functions only with completed mating jaws to hold the magnetic reluctance to a minimum and assure accuracy and repeatability of all current measurements.

7-35. The probe is not field calibratable and

depends on the transformer current ratio for accuracy.

7-36. CHECK THE OVER-VOLTAGE LIMITER

a. Connect the current probe to the V- Ω and COMMON inputs of the voltmeter. Set the function for ac voltage on the 2 V range.

b. Clamp the current probe jaws on a conductor carrying more than 50 amperes.

c. The voltage indicated on the voltmeter must not exceed 1.9 volts or the four current limiting diodes in the probe termination must be replaced. Use 3 ampere rated 50 volt diodes such as IN5400 Ballantine P/N 05100630A.

Measurement Range	Probe Range
0.1 to 100 A	0.1 to 100 A
1 to 1000 A	1 to 1000 A
10 to 10000 A	10 to 10000 A

7-37. CURRENT PROBE, AC, CLAMP-ON MODEL 10861A

7-38. GENERAL. The Ballantine Model 10861A AC Current probe extends the ac current measuring capability of Digital Multimeters. The probe covers a current range from 2 to 150 amperes. Frequency coverage is from less than 40 Hz to greater than 400 Hz. Nominal accuracy is $\pm 3\%$ at 60 Hz. A voltage limiter is incorporated in the current probe to protect the operator against electric shock and limits the output voltage to 2.4 volts peak to peak irrespective of the test current magnitude or DMM current range selected. The clamp-on feature allows ac currents to be measured without breaking into the leads of the circuit under test. The effect of moving the current conductor from the center to any position within the core jaws is less than 3%.

7-39. SPECIFICATIONS

Frequency Range: < 40 Hz to >400 Hz.

Current Range:

2 Amperes to 150 Amperes Sinusoidal Current.

Accuracy:

$\pm 4\%$ of Full Scale used. Calibrated at 60 Hz, with current conductor centered.

Frequency Response:

- >20 Amperes, 40 to 400 Hz: $\pm 3\%$ of Full Scale.
- >10 Amperes, 40 to 400 Hz: $\pm 4\%$ of Full Scale.
- > 2 Amperes, 40 to 400 Hz: $\pm 10\%$ of Full Scale.

Conductor Position:

The effect of moving the current conductor from center to any position within the tightly closed core jaws is < 3%.

Test Conductor Size:

Round Wires Diameter to 12 mm (.48 inch).

Rectangular and Square Conductors to 6.4 mm (.25 inch) cross section.

Foils and Sheets with maximum thickness of 2.8 mm (0.11 inch) and 1.8 inches wide.

Insulation:

Insulation of probe housing is designed for operation to 650 volts rms at 60 Hz.

Safety:

To protect the operator against shock, an over-voltage limiter on the output connections limits terminal voltage to 2.4 volts peak to peak irrespective of test current or load.

Connector:

Dual banana plugs spaced 1.9 mm (0.75 inches).

7-40. OPERATING INSTRUCTIONS

WARNING

The clamp-on probe housing is made of high quality insulation and designed to provide long service under stress of frequent usage. EXERCISE EXTREME CARE WHEN MEASURING HIGH CURRENTS AND WHEN CLAMPING ON WIRES OR APPLIANCES CARRYING HIGH POWER MAINS VOLTAGES.

NEVER USE THE PROBE WHEN THE INSULATING MATERIAL OR THE HOUSING IS DAMAGED OR WHEN THE MAGNETIC CORE MAY COME IN CONTACT WITH HIGH VOLTAGES.

7-41. Use the following procedure for operating the Model 10861A AC Clamp-On Current Probe.

- a. Plug the 10861A dual banana termination into the A and COMMON terminals of the DMM.
- b. Push the A pushbutton to select the current function.
- c. Select ac operation. The 10861A can be used on sinusoidal and distorted ac signals so that the rms responding detectors provide improved accuracy of measurement.
- d. Select the DMM Current Range as indicated below:

DMM Range	Measurement Range With 10861A Probe
20 mA	2 A to 20 A
200 mA	20 A to 150 A

- e. Clamp the probe around the current carrying conductor to be measured. Center the conductor within the core jaws. Make sure jaws are firmly closed and in full contact.

NOTE

Clamping the probe around more than one current carrying conductor at a time produces a reading on the DMM which is the vector sum of the currents in each of the conductors.

- f. Read the DMM. It is indicating the measured current in Amperes.

SECTION 8

OPTIONS

8-1. INTRODUCTION

8-2. This section contains information for the options which can be used with the Model 3036A/B Digital Multimeter. Each option is described individually. Where applicable, field installation procedures, operating and maintenance instructions, a replaceable parts list, and a schematic diagram are included.

8-3. PARALLEL BCD PRINTER OUTPUT, OPTION 01

8-4. GENERAL. The BCD output provides digital measurement information in parallel BCD format to a rear-panel connector for use with digital printers, systems, limit controllers, and other remote applications.

8-5. SPECIFICATIONS

<u>TYPE:</u>	Serial to parallel converter
<u>LOGIC:</u>	Positive true
<u>FORM:</u>	Four-line BCD 1-2-4-8. CMOS derived, TTL compatible. Fan-out of two low power TTL. "1" = +3.5 V dc to 5.7 V dc. "0" = 0 to 0.4 V dc. DP Logic CMOS compatible only.

CONTINUOUS DATA OUTPUT UPDATE COMMAND: By holding "0" state, the BCD output is updated at an internal trigger rate of typically four per second.

BUSY FLAG (PRINTER INHIBIT): "0" state at Busy Flag output signifies BCD output in process of updating. During this interval, all Data Update commands from printer are ignored. "1" state signifies not Busy. Busy Flag internally modifiable to Ready.

8-6. OPERATION

8-7. INPUT/OUTPUT DATA. The input/output data available at the rear panel connector J2 is listed in Table 8-1. The pin assignments and the logic level requirements are also listed.

8-8. DATA UPDATE INPUT. The Continuous Update command at pin 22, when held at "1" state, will cause the BCD output to be updated at the DMM's display refresh rate of approximately three-four times per second. To modify operation for continuous update, proceed as follows:

1. Disconnect the power cord.
2. Remove the top cover of the instrument case. Refer to paragraph 5-33.
3. Locate LK1 (a solder link near U9 on BCD output assembly).
4. Install solder link LK1.
5. Replace the top cover and reconnect the power cord.

8-9. BUSY FLAG OUTPUT. The time period of actual updating of the BCD output at pin 2 of the BCD output connector, J2. During this period all external update pulses are locked out and therefore ignored. A signal LOW shows not Busy. This feature operates as the conventional "print" command. A simple modification on the BCD output printed circuit board assembly permits the Busy Flag logic to be inverted and thereby used as a Ready Flag. A signal HIGH on pin 2 will then show that the BCD output is ready for update. A signal LOW indicates not Ready since the serial-to-parallel converter is being updated by the counter. To modify the Busy Flag, proceed as follows:

1. Disconnect the power cord.
2. Remove the top cover of the instrument case. Refer to paragraph 5-33.
3. Locate LK2 (a solder link switch near U5 on the BCD output assembly).
4. Refer to the BCD schematic, Figure 8-1, and remove solder link LK2.
5. Install solder link LK3 to provide a Ready Flag.
6. Replace the top cover and reconnect the power cord.

8-10. BCD OUTPUT CABLE. One-meter long BCD output cable with one mating 26 pin card edge connector (Ballantine P/N 89-11264-1) is available as an option. The cable is a 26 wire flat ribbon cable. It is unterminated so that the user may wire his own connector.

8-11. THEORY OF OPERATION. The BCD printer output option is a serial to parallel converter with associated control circuitry. It processes the serial output data from U-6 in the 3036A/B into parallel BCD format. Five type D flip-flops in U1, U2, U3, U4 and U7 are the storage registers

which store serial data bits. A, B, C, D and sign using digit strobes D5, D4, D3, D2 and D1.

8-12. Update may be continuous at the sampling rate of the 3036A/B or inhibited by high level at the data update line pin 22, J2. Low level at the input of U6A pin 2 will enable the M/Z pulses. At the end of the zero interval the M/Z line will go high which will preset USA and send a print command on pin 2, J2.

8-13. "D" flip-flops U1, U2, U3, U4 and U5 are strobed with the digits strobes in sequence shown

in Figure 8-1. The "d" flip-flops are being controlled by U5B. D5 pulse enables the data input into the flip-flops and D1 pulse disables it. U1 through U4 and U7 provide buffered outputs to drive 2 Low Power TTL or CMOS.

8-14. At time D5, which is the most significant digit, a high level on B1 will indicate over range.

8-15. Polarity will be indicated at D5 strobe time.

TABLE 8-1. DIGITAL I/O DATA AT J-2

PIN NO.	NO. OF LINES	SIGNAL	SIGNAL LOGIC		LOGIC LEVEL	
			HIGH	LOW	"1"	"0"
21	1	M.S.D. (most significant digit)	1	0	3.5 to 5 V dc	0 to 0.4 V dc
19	4	2nd M.S.D.	0			
20			2	0		
7			4	0		
6			8	0		
17	4	3rd M.S.D.	1	0		
18			2	0		
9			4	0		
8			8	0		
12	4	4th M.S.D.	1	0		
16			2	0		
11			4	0		
10			8	0		
15	4	L.S.D.	1	0		
14			2	0		
1			4	0		
24			8	0		
5	1	Polarity	+	-		
4	1	Overrange	Over-range	-		
2	1	Busy Flag*	Busy	Not Busy		
22	1	Continuous Update* (Input)	Inhibit	Update		
3	1	Logic Common	on	-		
13	1	Decimal Pt 1 (MSD)	on	-		
25	1	Decimal Pt 2	on	-		
23	1	Decimal Pt 3	on	-		
26	1	Decimal Pt 4	on	-		

*Compliment available with Internal Strap

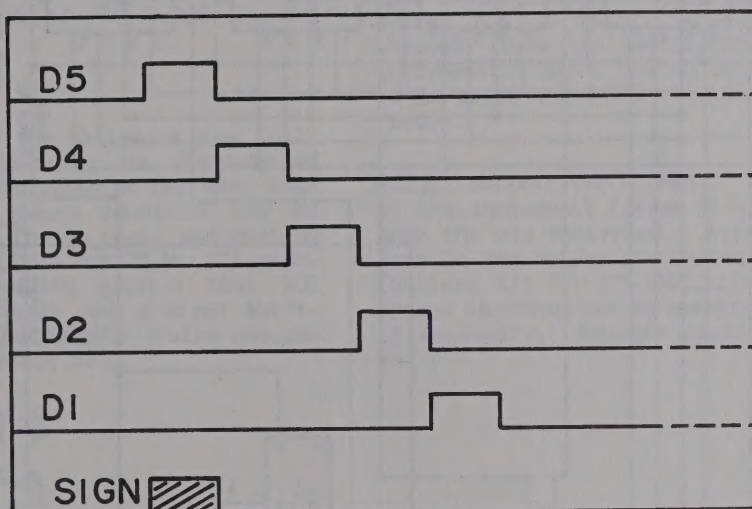
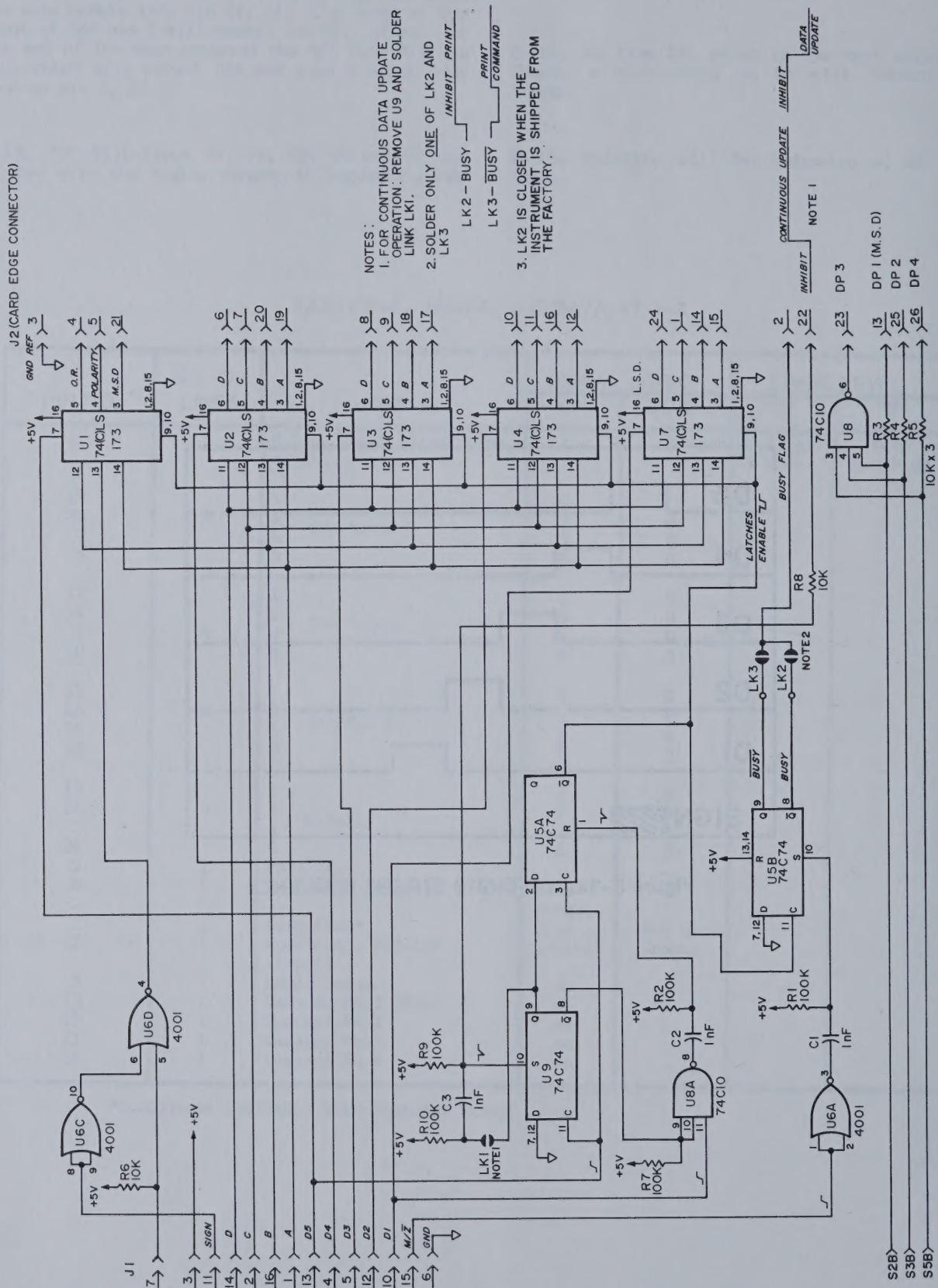


Figure 8-1a. (A) DIGITS STROBE SEQUENCE



8-16. INTERNAL RECHARGEABLE BATTERY, OPTION 05.

8-17. GENERAL. Option 05 equips the Model 3036A/B with four rechargeable nickel-cadmium batteries, installed as shown in Figure 8-2, which can be used in place of ac power to operate the instrument. The optional battery connections and the charger circuit are shown in Figure 6-1. The batteries are recharged by setting the POWER switch (S0) to OFF and connecting the ac power to the instrument. The 3036B-968 incorporates Option 05 as standard (See Table 1-3).

8-18. SPECIFICATIONS

CONTINUOUS OPERATION: 6 hours (20°C to 30°C)

CHARGE TIME: 14 hours (15°C to 35°C)

BATTERY LIFE: 350 to 500 full charge-discharge cycles

BATTERY TYPE: Four NiCad "C" cells in the 3036A and 3036B and four NiCad "D" cells in the 3036B-968.

8-19. OPERATION. When the batteries are fully charged, the Model 3036A/B may be disconnected from the ac power line and operated for more than 6 hours. The battery charge condition may be checked by disconnecting the ac power and pushing in the POWER (S0), DCV (S10) and 20 M (S7) push-buttons. A display reading greater than 500 indicates that the batteries are charged sufficiently to operate the instrument. Fully charged batteries will indicate above 530.

NOTE

It is recommended that NiCad batteries be recharged at least every 90 days and that they be stored where the temperature is below +30°C (+86°F).

8-20. INSTALLATION. Battery Option 05 is easily installed in the field. Remove the covers of the instrument (refer to paragraph 5-33). Attach and secure the battery holder and the mounting plate to the underside of the top cover with the screws supplied; install the terminal lug under the right screw. Solder the blue lead to the terminal lug and to the instrument ground. Solder the battery red lead to the + terminal and the black lead to the - terminal, located at the rear left corner of the main printed wiring assembly.

Install and solder the battery charger components in the holes provided in the printed wiring assembly board.

8-21. With the ac power cord connected, but with the POWER switch OFF, allow the batteries to charge for 14 hours. After the batteries are charged, check the battery-power operation of the instrument. Check the battery charge as instructed in paragraph 8-19. Replace the top and bottom covers.

8-22. BATTERY REPLACEMENT. Remove the top cover of the instrument (refer to paragraph 5-33). Remove the old batteries. Note the polarity markings in the holder and install four new batteries (Battery Kit P/N 89-10422-1). Check the battery charge as described in paragraph 8-19 and recharge if necessary. Replace cover and attaching hardware.

TABLE 8-2. PARTS LIST, INTERNAL RECHARGEABLE BATTERY, OPTION 05

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
BT..1	85-10059-0A	BNC C NICK-CAD 1.5 AH	09823	GOULD 2.08 CB
BT..2	85-10059-0A	BNC C NICK-CAD 1.5 AH	09823	GOULD 2.08 CB
BT..3	85-10059-0A	BNC C NICK-CAD 1.5 AH	09823	GOULD 2.08 CB
BT..4	85-10059-0A	BNC C NICK-CAD 1.5 AH	09823	GOULD 2.08 CB
CR.20	05-09481-0A	DGP IN4005 600 1A	04713	MOT SI D041
CR.21	05-10026-0A	DGP IN4151 75 50M	24446	GE SI D035 4 2
Q..20	10-10064-0A	TRQ 2N5135 NPN 1 25	07263	FCH .8 40M 50
Q..23	10-10064-0A	TRQ 2N5135 NPN 1 25	07263	FCH .8 40M 50
Q..28	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	04713	MOT 1 250M 60
R..61	12-13157-0A	RFF 90.0K 500.0MW B	16299	CGW RN60E 25 PPM
R..62	12-13130-0A	RFF 10.0K 500.0MW B	16299	CGW RN60E 25 PPM
R..70	12-01265-0A	RFC 3.9 1.0W K+-10%	01121	A-B TYPE GB
R..71	12-08018-0A	RFC 470.0 250.0MW J+-5%	01121	A-B TYPE CB
R..72	12-08023-0A	RFC 2.2K 250.0MW J+-5%	01121	A-B TYPE CB
R..73	12-08019-0A	RFC 47.0 250.0MW J+-5%	01121	A-B TYPE CB
R..74	12-08018-0A	RFC 470.0 250.0MW J+-5%	01121	A-B TYPE CB
R..75	12-01242-0A	RFC 330.0 250.0MW K+-10%	01121	A-B TYPE CB
R..76	12-08023-0A	RFC 2.2K 250.0MW J+-5%	01121	A-B TYPE CB
R..78	12-08023-0A	RFC 2.2K 250.0MW J+-5%	01121	A-B TYPE CB

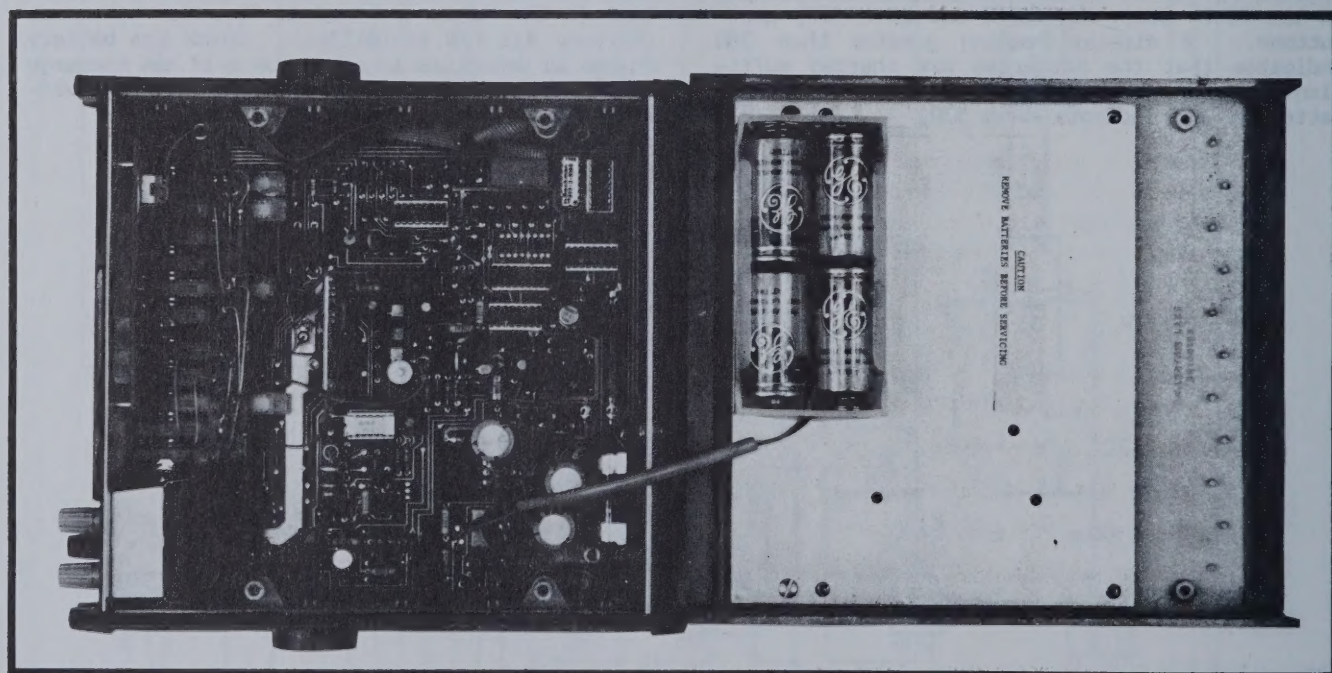


Figure 8-2. Battery Option 05 Installed

8-23. 20-AMPERE CURRENT RANGE, OPTION 21

8-24. GENERAL. The 20 ampere current range option extends the current measuring capability of the 3036A/B to 20 amperes for both ac and dc rms current. Continuous measurements may be made to 10 amperes. Currents to 15 amperes are limited to 1 1/2 minutes and a duty cycle of 50%. Currents to 20 amperes are limited to 1 minute and a duty cycle of 25%. The standard performance characteristics and specifications of the 3036A/B are not altered with Option 21 installed.

8-25. DC SPECIFICATIONS

RANGES: ± 20.00 amperes

1.5 minute operation to ± 15 amperes

1 minute operation to ± 20 amperes

ACCURACY (15° to 35°C):

$\pm (0.5\% \text{ of reading} + 1 \text{ LSD})$

VOLTAGE BURDEN: 0.5 V maximum to 10 A

MAXIMUM INPUT: ± 20 amperes

OPERATING TIME:

Continuous to ± 10 amperes

1.5 minutes to ± 15 amperes (50% duty cycle)

1 minute to ± 20 amperes (25% duty cycle)

RESPONSE TIME: 500 ms

8-26. AC SPECIFICATIONS

RANGES: 20 amperes

1.5 minute operation to 15 amperes

1 minute operation to 20 amperes

ACCURACY (+15 to +35°C):

15 Hz to 10 kHz (sine wave)
 $\pm (2\% \text{ of reading} + 3 \text{ LSD})$

45 Hz to 3 kHz (sine wave)
 $\pm (1\% \text{ of reading} + 2 \text{ LSD})$

For distorted waveforms having less than 10% total harmonic distortion with no single harmonic greater than 5%, add $\pm (1.5\% + 2 \text{ LSD})$ to the sine wave accuracy specified.

VOLTAGE BURDEN: 0.5 V to 10 A for sine waves

MAXIMUM INPUT: 20 A

OPERATING TIME:

Continuous to 10 A

1.5 minutes to 15 A (50% duty cycle)

1 minute to 20 A (25% duty cycle)

RESPONSE TIME: 3 seconds maximum

8-27. OPERATION

a. Push the DMM pushbutton switches to POWER ON, to ACA or DCA as required, and 20 M (S6).

b. Connect the input current leads to tight-fitting, clean, banana plugs which are connected to the 20 ampere range banana jacks on the front panel. Observe polarity for dc current measurements by connecting negative lead to LO connector. Always use the LO connector for the LO side of ac current inputs.

CAUTION

Do not exceed 20 amperes and the duty factors specified. Always set all switches before connecting signal to the 20 ampere input.

8-28. THEORY OF OPERATION. A schematic diagram of the 20 ampere current range option is shown in Figure 8-3. A 0.01 ohm resistor is inserted into the low end sensing return of the 0.1 ohm shunt resistor of RN200. The 0.01 ohm resistor is also a four terminal network and is connected directly to its own input connector to avoid additional range switching. Proper positioning of the decimal point is performed by depressing the 20 m range pushbutton S9.

8-29. REPLACEABLE PARTS

R1200 Resistor, 0.01 ohm, P/N 12129551
four-terminal

- Window P/N 47100341

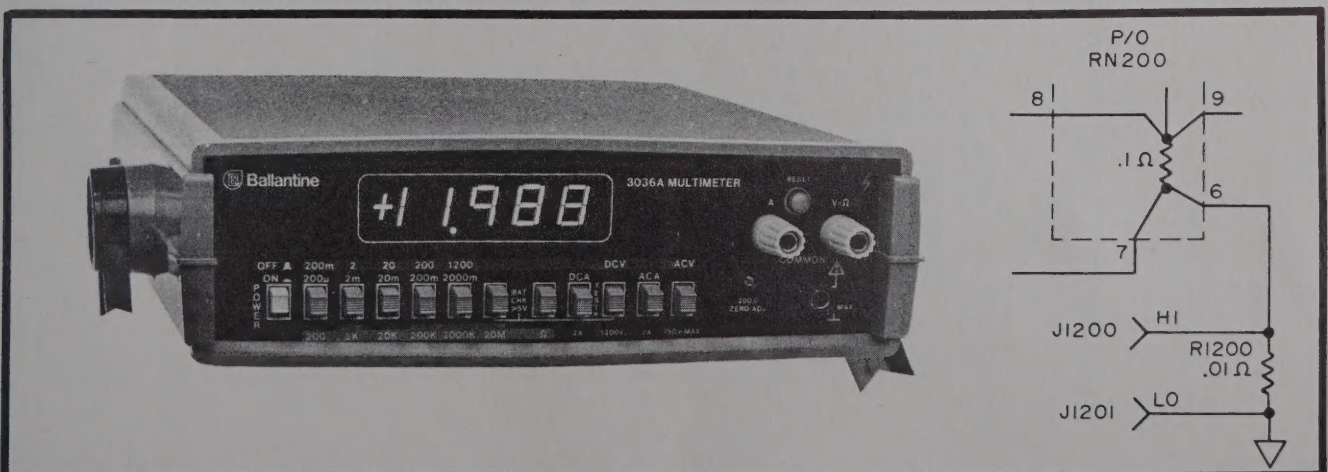


Figure 8-3. Option 21, Front Panel and Schematic Diagram

Applicable To Units With
Serial Prefix No. 020-

PARTS LIST 3036A/B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C..1	07-10484-0A	CYF 68.0NF 1.0KV =-20%	50423	
C..2	07-10268-0A	CVG 5-18PF 1.0 KV GLASS TR	50423	
C..3	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C..4	07-09550-0A	CCD 100 NF 12 V M 20%	72982	REFER TO 07-09589-0A
C..5	07-09581-0A	CET 2.2UF 35 V K 10%	50423	
C..6	07-10087-0A	CMD 390.0PF 100 VIJ	84171	ARCO TYPE RDM15-391J
C..7	07-02540-0A	CCD 5.0NF 100.0 V +-20%	4171	ARCO #T CPR005 OR EQUAL
C..8	07-10293-0A	CBM 33.0NF 100.0 VJ	50587	PLESSEY 161 SER MINIBOX
C..9	07-10340-0A	CBM 22.0NF 400.0 V +-10%	80031	MEPCO C280MCF/A22K
C.10	07-10354-0A	CMD 1.0NF 500.0 V +- 1%	84171	ARCO DM-19-E-D-1000-F-N-U
C.11	07-10301-0A	CBM 680.0NF 63.0 VJ	50587	PLESSEY 161 SER MINIBOX
C.12	07-10103-0A	CMD 250.0PF 500 V +-5%	84171	ELMENCO DM1525J
C.13	07-09564-0A	CCD 5 NF 1 KV M 20%	56289	SPG TYP 5G1-D50
C.14	07-09571-0A	CCD 50 NF 50 V	71590	CTL TYP CK503
C.15	07-10117-0A	CMD 12.0PF 500.0 VJ	84171	ELMENCO DM15C120JN
C.16	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C.17	07-10053-0A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X0035A3
C.18	07-09550-0A	CCD 100 NF 12 V M 20%	72982	REFER TO 07-09589-0A
C.19	07-10418-0A	CMD 750.0PF300.0 VJ	53201	SANGAMO CM05E0751J03, EQ
C.20	07-10447-0A	CEA2200.0UF 16.0 V	50423	
C.21	07-10447-0A	CEA2200.0UF 16.0 V	50423	
C.22	07-10418-0A	CMD 750.0PF300.0 VJ	53201	SANGAMO CM05E0751J03, EQ
C.23	07-10009-0A	CCD 2.2NF 500 V DISC	73345	AMPEREX C0238501E222P
C.24	07-10093-0A	CEA 100.0UF 16 V UPPC MNT	0	STET-TRUSH ERO EK100/16
C.25	07-10092-0A	CEA 470.0UF 35. V	0	STET-TRUSH ERO EGK470/35
C.27	07-10012-0A	CMD 100.0PF 100 V J DIPMICA	84171	ARCO TYPE RDM15-101J
C.28	07-10183-0A	CET 47.0 UF 20.0 VM DIP TAN	56289	SPRAGUE 196D476X0020-LA3
CR.1	05-09468-0A	DGP FD300 150 175M .4	7263	FCH SI D07
CR.2	05-09468-0A	DGP FD300 150 175M .4	7263	FCH SI D07
CR.3	05-09481-0A	DGP 1N4005 600 1A	4713	MOT SI D041
CR.4	05-10110-0A	DZG 1N4571 6.2V 1MA	4713	MOT 1N4571
CR.5	05-09481-0A	DGP 1N4005 600 1A	4713	MOT SI D041
CR10	05-10026-0A	DGP 1N4151 75 50M	24446	GE SI D035 4 2
CR11	05-09469-0A	DGP MDA920A-2 50 1A	4713	MOT BRIDGE REC
CR12	05-10026-0A	DGP 1N4151 75 50M	24446	GE SI D035 4 2
CR22	05-10071-0A	DGP 1N4934 100 1A	7263	FCH SI 200
CR23	05-10066-0A	DZG 1N 759 12 20M	4713	MOT SI
CR24	05-10071-0A	DGP 1N4934 100 1A	7263	FCH SI 200
CR25	05-09481-0A	DGP 1N4005 600 1A	4713	MOT SI D041
L..1	03-10056-0A	CIL .33MH INDUCTOR	83125	NYTRONICS WEE330
Q..1	10-10143-0A	TRQ NSD135 NPN BVCB 350V	27014	NATIONAL NSD135
Q..2	10-10035-0A	TRQ 2N4126 PNP 25 PTO-92	4713	MOT 1 250M 60
Q..3	10-10144-0A	TRQ 2N5416PNP BVCB 300V	4173	MOTOROLA
Q..4	10-10130-0A	TRQ E108 N J FET TO-106	17856	SILICONIX E108 A0S=BOHMS
Q..5	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q..6	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q..7	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q..8	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q..9	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.10	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.11	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.12	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.13	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.14	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.15	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50
Q.16	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q.17	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q.18	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q.19	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q.20	10-10080-0A	TRQ 2N4403 PNP	4713	MOTOROLA
Q.21	10-10145-0A	TRQ E211 JFET N CHANNAL	50423	
Q.24	10-09457-0A	TRQ 2N4918 PNP 1 40 P	4713	30 3M 20
Q.26	10-10034-0A	TRQ 2N4124 NPN 1 25 PTO-92	4713	MOT 1 300M 50

PARTS LIST 3036A/B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
Q.27	10-10034-0A	TRQ 2N4124 NPN 1 25 PT0-92	4713	MOT 1 300M 50
Q.29	10-10143-0A	TRQ NSD135 NPN BVCB 350V	27014	NATIONAL NSD135
QN.1	10-10133-0A	TRQ CA3081 NPN 7 16V S16DIP	86684	RCA 0.5W 70
R..1	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	16299	CGW RN60D 5623 F
R..5	09-10004-0A	RVF 100.0 0.5 W M	73138	HEL TYP 72PM
R..6	12-13124-0A	RFF 8.95K 500.0MW B	16299	CGW RN60E 25PPM
R..8	12-13125-0A	RFF 1.0 K 500.0MW B	16299	CGW RN60E 25PPM
R..9	12-01263-0A	RFC 47.0 K 1.0 W K+-10%	1121	A-B TYP GB
R.10	12-13126-0A	RFF 9.0 K 500.0MW B	16299	CGW RN60E 25PPM
R.11	12-13125-0A	RFF 1.0 K 500.0MW B	16299	CGW RN60E 25PPM
R.12	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.13	12-12835-0A	RFW 900.0 2.0 W 0.1%	91637	DALE RS-2C OR EQUIV
R.14	12-12836-0A	RFW 90.0 2.0 W 0.1%	91637	DALE RS-2C OR EQUIV
R.15	12-12837-0A	RFW 9.0 2.0 W 0.1%	91637	DALE RS-2C OR EQUIV
R.16	12-12838-0A	RFW 0.9 2.0 W 0.1%	91637	DALE RS-2C OR EQUIV
R 13 *	12-13201-0A	RFW 900.0 2.0 W 0.5%	91637	DALE RS-2C OR EQUIV
R 14 *	12-13202-0A	RFW 90.0 2.0 W 0.5%	91637	DALE RS-2C OR EQUIV
R 15 *	12-13203-0A	RFW 9.0 2.0 W 0.5%	91637	DALE RS-2C OR EQUIV
R 16 *	12-13204-0A	RFW 0.9 2.0 W 0.5%	91637	DALE RS-2C OR EQUIV
R.17	12-12839-0A	RVW 0.1 SLIDE TAP ADJUST	50423	
R.19	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.20	12-08042-0A	RFC 270.0 250.0MW J+- 5%	1121	A-B TYP CB
R.21	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	1121	A-B TYP CB
R.22	12-12300-0A	RFF 1.0 K 250 MW F+-1%	16299	CGW RN55D 1001 F
R.23	12-12378-0A	RFF 6.49K 250.0MW F+- 1%	16299	CGW RN55D 6491 F
R.24	09-10107-0A	RVF 200.0 250.0MW K CER	73138	HEL TYPE 72PM-200
R.26	12-12862-0A	RFC 560.0 K 2.0 W 5%	1121	A-B HB
R.27	12-08040-0A	RFC 470.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.28	12-08042-0A	RFC 270.0 250.0MW J+- 5%	1121	A-B TYP CB
R.31	12-13127-0A	RFF 75.0 K 500.0MW B	16299	CGW RN60E 25PPM
R.32	09-10201-0A	RVF 2.0 K+-20% 500.0MW	73138	HEL IPOT 72XW2K
R.33	12-12476-0A	RFF 61.9 K 250.0MW F+- 1%	16299	CGW RN55D 6192 F
R.34	12-12464-0A	RFF 46.4 K 250.0MW F+- 1%	16299	CGW RN55D 4642 F
R.35	12-13128-0A	RFF 100.0 K 500.0MW B	16299	CGW RN60E 25PPM
R.36	12-13129-0A	RFF 10.9 K 500.0MW B	16299	CGW RN60E 25PPM
R.37	09-10107-0A	RVF 200.0 250.0MW K CER	73138	HEL TYPE 72PM-200
R.38	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	1121	A-B TYP CB
R.39	12-08029-0A	RFC 1.0 M 250.0MW J+- 5%	1121	A-B TYP CB
R.40	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.41	12-06107-0A	RCF 10.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.42	12-12364-0A	RFF 4.64K 250.0MW F+- 1%	16299	CGW RN55D 4641 F
R.43	12-01224-0A	RFC 2.7 250.0MW K+-10%	1121	A-B TYP CB
R.44	12-12572-0A	RFF 562.0 K 500.0MW F+- 1%	16299	CGW RN60D 5623 F
R.45	09-10134-0A	RVF 50.0 K 0.5 W +-30%	73138	HEL IPOT 72PM
R.46	12-08016-0A	RFC 1.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.47	12-09804-0A	RFC 110.0 250.0MW J+- 5%	1121	A-B TYP CB
R.49	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.50	12-08010-0A	RFC 68.0 250.0MW J+- 5%	1121	A-B TYP CB
R.51	12-08010-0A	RFC 68.0 250.0MW J+- 5%	1121	A-B TYP CB
R.52	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.53	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.54	12-01085-0A	RFC 120.0 K 500.0MW J+- 5%	1121	A-B TYP EB
R.55	12-08023-0A	RFC 2.2 K 250.0MW J+- 5%	1121	A-B TYP CB
R.56	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.57	12-12272-0A	RFF 562.0 250 MW F+-1%	16299	CGW RN55D 5620 F
R.58	12-09804-0A	RFC 110.0 250.0MW J+- 5%	1121	A-B TYP CB
R.59	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.60	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.63	12-08019-0A	RFC 47.0 250.0MW J+- 5%	1121	A-B TYP CB

* Used on 3036B only.

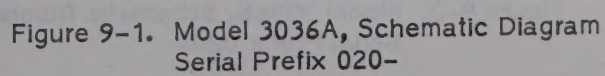
PARTS LIST 3036A/B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R.64	12-08954-0A	RFC 6.8 K 500.0MW J+- 5%	1121	A-B TYP EB
R.65	09-10195-1A	RVC 5.0. K +-30% LIN SHF 1/8	11236	CTS XBE200 50K +- 30%
R.66	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.67	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.79	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.80	12-01224-0A	RFC 2.7 250.0MW K+-10%	1121	A-B TYP CB
R.81	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.82	09-10134-0A	RVF 50.0 K 0.5 W +-30%	73138	HELIPOT 72PM
R 84 *	09-10116-0A	100.0 K	73138	HELIPOT 72 PM
R 85 *	09-10124-0A	10.0 K	73138	HELIPOT 72 PM
R 86 *	09-10006-0A	1.0 K	73138	HELIPOT 72 PM
R 87 *	12-12128-0A	19.6Ω	73138	CGW RN55D
RN.1	13-10006-0A	RNF 2.0 K 250.0MW B7RES DIP	80053	BECKMAN 899-3-R 2.0K
RN.2	13-10044-0A	RNF 100.0 14 1.5W 14DIP 7R	80053	BECKMAN 899-3-R100
RN.3	13-10075-0A	RNF 3036 ATTENUATOR .04%MATC	0	CADDOCK 1776-101
S..0	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..1	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..2	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..3	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..4	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..5	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..6	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..7	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S..8	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S..9	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S.10	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S.11	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
T..2	20-40062-0A	TRX 3036A DC/DC CONVERTER	50423	
U..1	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	24355	ANALOG DEVICES AD536J
U..3	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..4	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..5	24-10210-1A	ICP LD120CJ MOD DVM .005%	50423	
U..6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	86664	SILICONIX-ANALOG
U..7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	2413	MOTOROLA OR EQUIV
U..8	24-10255-0A	ICP MC14512 MULTIPLEXER	4713	MOTOROLA MC14512
U..9	24-10256-0A	ICP REF-02C 25PPM VOLT REF.	0	PMI REF-02C
U 9 *	24-10285-0A	ICP REF-02H 10 PPM VOLT REF		PMI REF-02H
U.20	24-10001-0A	TCD UA7805	7263	FAIRCHILD

PARTS LIST 3036A/B FRONT PANEL

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
DS.1	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.2	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.3	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.4	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.5	21-10041-0A	IND 0.43 IN.HIEF.RED CC +-1	28480	HP 5082-7656 COMMON CAT.
J..1	31-10132-0A	BPS 10MM GREY	50423	
J..2	31-10132-0A	BPS 10MM GREY	50423	
J..4	31-10133-0A	BPS 10MM BLACK'	50423	

* Used on 3036B only.



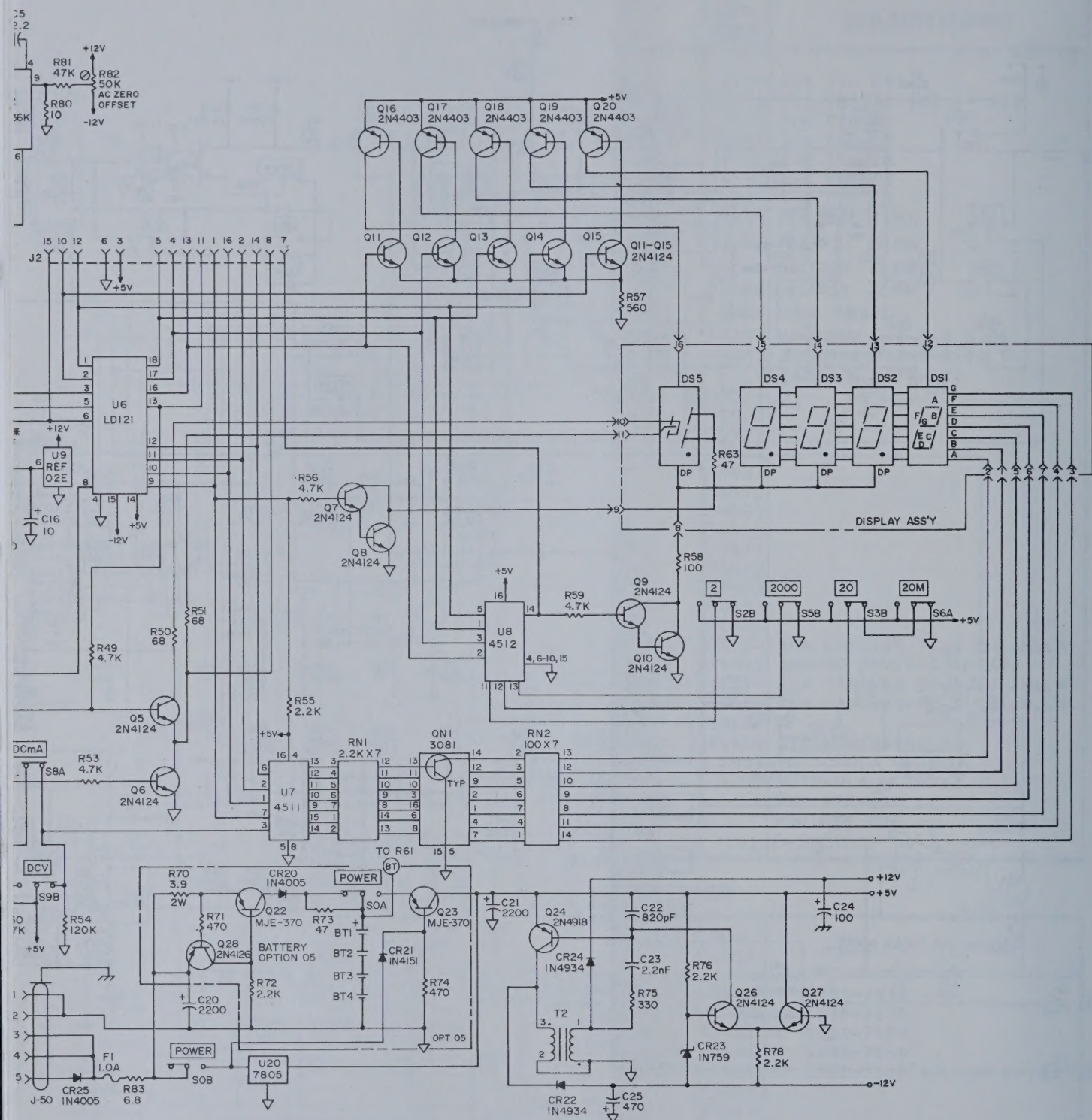
PARTS LIST 3036A/B

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R.64	12-08954-0A	RFC 6.8 K 500.0MW J+- 5%	1121	A-B TYP EB
R.65	09-10195-1A	RVC 5.0. K +-30% LIN SHF 1/8	11236	CTS XBE200 50K +- 30%
R.66	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.67	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.79	12-01048-0A	RFC 4.7 K 500.0MW J+- 5%	1121	A-B TYP EB
R.80	12-01224-0A	RFC 2.7 250.0MW K+-10%	1121	A-B TYP CB
R.81	12-08014-0A	RFC 47.0 K 250.0MW J+- 5%	1121	A-B TYP CB
R.82	09-10134-0A	RVF 50.0 K 0.5 W +-30%	73138	HELIPOT 72PM
R 84 *	09-10116-0A	100.0 K	73138	HELIPOT 72 PM
R 85 *	09-10124-0A	10.0 K	73138	HELIPOT 72 PM
R 86 *	09-10006-0A	1.0 K	73138	HELIPOT 72 PM
R 87 *	12-12128-0A	19.6Ω	73138	CGW RN55D
RN.1	13-10006-0A	RNF 2.0 K 250.0MW B7RES DIP	80053	BECKMAN 899-3-R 2.0K
RN.2	13-10044-0A	RNF 100.0 14 1.5W 14DIP 7R	80053	BECKMAN 899-3-R100
RN.3	13-10075-0A	RNF 3036 ATTENUATOR .04%MATC	0	CADDOCK 1776-101
S..0	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..1	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..2	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..3	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..4	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..5	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..6	25-40181-0A	SWC 3036A RANGE SWITCH	50423	
S..7	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S..8	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S..9	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S.10	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
S.11	25-40182-0A	SWC 3036A FUNCTION SWITCH	50423	
T..2	20-40062-0A	TRX 3036A DC/DC CONVERTER	50423	
U..1	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..2	24-10251-0A	ICP AD536J TRUE RMS-DC CONN	24355	ANALOG DEVICES AD536J
U..3	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..4	24-10212-0A	ICP CA3140E FET OP AM MINDIP	86684	RCA CA3140S TO-5 CU.JN.LN
U..5	24-10210-1A	ICP LD120CJ MOD DVM .005%	50423	
U..6	24-10211-1A	ICP LD121CJ MOD DIG 4 1/2	86664	SILICONIX-ANALOG
U..7	24-10109-0A	ICP MC14511 7 SEGMENT DRIVE	2413	MOTOROLA OR EQUV
U..8	24-10255-0A	ICP MC14512 MULTIPLEXER	4713	MOTOROLA MC14512
U..9	24-10256-0A	ICP REF-02C 25PPM VOLT REF.	0	PMI REF-02C
U 9 *	24-10285-0A	ICP REF-02H 10 PPM VOLT REF		PMI REF-02H
U.20	24-10001-0A	TCD UA7805	7263	FAIRCHILD

PARTS LIST 3036A/B FRONT PANEL

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
DS.1	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.2	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.3	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.4	21-10046-0A	UBD 0.43 IN HI-EFF RED C.A.0	28480	HP 5082-7650
DS.5	21-10041-0A	IND 0.43 IN.HIEF.RED CC +-1	28480	HP 5082-7656 COMMON CAT.
J..1	31-10132-0A	BPS 10MM GREY	50423	
J..2	31-10132-0A	BPS 10MM GREY	50423	
J..4	31-10133-0A	BPS 10MM BLACK'	50423	

* Used on 3036B only.





Ballantine Laboratories, Inc.

ADDENDUM

TO INSTRUCTION MANUAL:

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(90-10212-5B) #1

APPLIES TO ALL UNITS

Page 5-7. Paragraph 5-45. INITIAL CHECK AND WARM UP

CHANGE TO READ: a. Push DCV and DCA simultaneously for display test reading of +888.8.



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